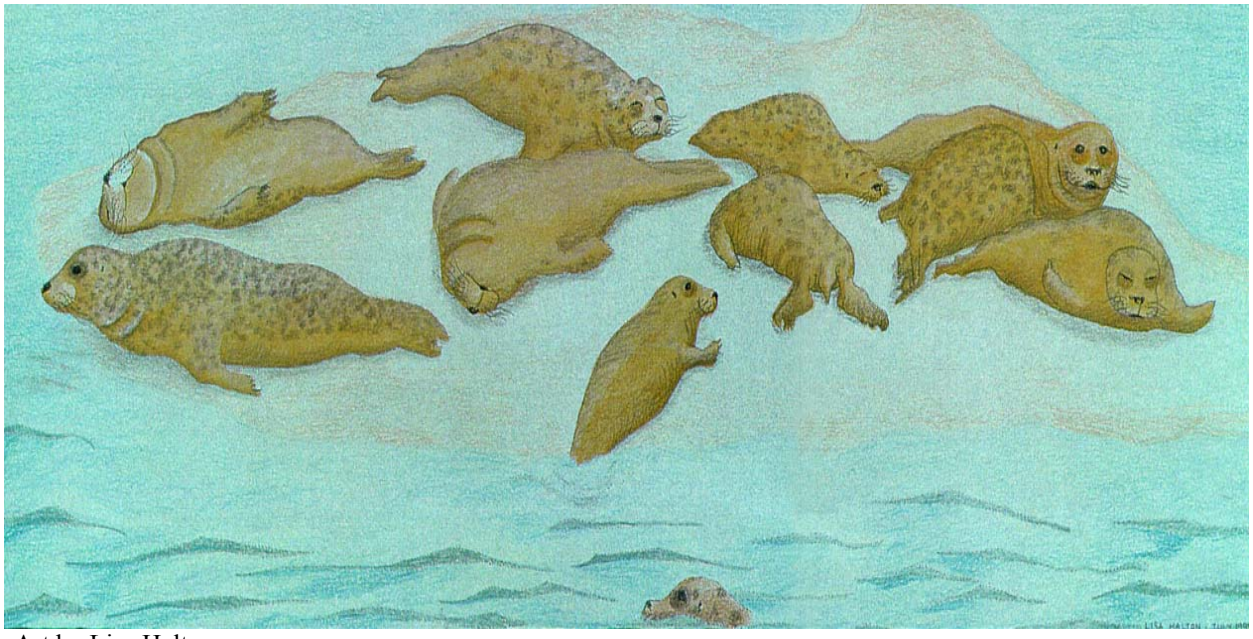

Art by Lisa Halton

LONG-TERM MONITORING OF HARBOR SEALS AT POINT REYES, CALIFORNIA

5-YEAR ANNUAL REPORT 1997-2001

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Introduction

Harbor seals are the dominant and only resident pinniped at Point Reyes, California. The Point Reyes population also represents the largest concentration of harbor seals in the State of California other than the Channel Islands, accounting for 20% of the mainland breeding population (Sydeman and Allen 1999). Much of the Point Reyes coastal zone remains fairly pristine and provides excellent habitat for seals to rest, molt and breed where human encroachment is minimal.

Long-term monitoring studies of harbor seals have been conducted at selected colonies at Point Reyes since 1976 (Allen et al. 1989, Sydeman and Allen 1999) in order to 1) detect changes in population numbers, 2) detect changes in reproductive success and 3) identify anthropogenic or environmental factors that might affect population status. In the past, significant increases in the population of harbor seals at Point Reyes have been documented at most colonies, except at Tomales Bay where there was substantial human activity (Allen et al. 1989, Allen and King 1993) and at Point Reyes Headland where northern elephant seals are expanding (Sydeman and Allen 1999).

The information presented here is an update on the status and trend of the harbor seal population at Point Reyes. It represents a five-year summary of data collected prior to, during and three years following the 1998 El Nino Southern Oscillation (ENSO) event. We have also included two years of information from adjacent areas (San Francisco Bay and Sonoma County) where surveys were conducted in conjunction with other agencies and organizations as part of a region-wide survey effort.

Methods

Study Area

The Point Reyes coastline extends from Tomales Bay (Lat. 38° 30'N) south to Bolinas Lagoon (Lat. 37° 30'N). Coastal embayments include Tomales Bay, Drakes Estero and Limantour Estero, and Bolinas Lagoon. The Point Reyes National Seashore (PRNS), Golden Gate National Recreation Area (GGNRA), Gulf of the Farallones National Marine Sanctuary (GFNMS), and the Marin County Department of Parks and Recreation share jurisdiction over segments of this coastline. In addition to the protection afforded by these agencies, Bird Rock, Point Reyes Headland, and Double Point were designated by the California Department of Fish and Game and the California Water Resources Control Board as Areas of Special Biological Significance because of their unique biological attributes and now reclassified as State Water Quality Protection Areas in 2003 (Chan 1979; SWQPA).

The topographic diversity of this coastal zone provides a broad range of substrates upon which harbor seals haul out. These include tidal mud flats, offshore tidal ledges, and sandy beaches. "Haul out site" is defined as a terrestrial location where seals aggregate for periods of rest, birthing, and suckling of young (Harvey 1987, Thompson 1987).

Coastal locations include Tomales Point, Point Reyes Headland, and Double Point; estuarine locations include Tomales Bay, Drakes Estero and Limantour Estero, and Bolinas Lagoon (Figure 1a).

Because of its agricultural character, much of this coastline has remained largely undeveloped, even prior to inclusion in the 1960's and 70's in PRNS and GGNRA. The inaccessibility of much of the area has historically afforded protection from human disruption during the seals' terrestrial resting periods; however, prior to the Marine Mammal Protection Act (MMPA) of 1972, harbor seals at Point Reyes were commonly hunted by fishermen and ranchers (S. Allen, pers. comm.). After passage of the MMPA, the colonies at Point Reyes grew significantly (Allen et al. 1989). Currently, human disturbances may be on the rise with increased recreational use of public lands. From 1997-2000 PRNS alone recorded close to 2.4 million visitors annually (Monthly Statistical Report, PRNS, 2000).

Surveys

Harbor seal surveys were conducted during the breeding and molting seasons of 1997-2001, which respectively run from 15 March to 15 June and 15 June to 15 July. Regular survey sites included Double Point, Drakes Estero and Limantour Estero, Tomales Point (2 sites), Tomales Bay (3 sites), Point Reyes Headland, and Bolinas Lagoon. Duxbury Reef was added to the survey area in 1999.

National Park Service (NPS) biologists trained volunteers to conduct surveys of harbor seals during one in-class session and four field sessions. Many of the volunteers were seasoned, having surveyed seals in previous years. Volunteers and park biologists surveyed each site a minimum of twice per week, weather and logistics permitting. Surveys occurred primarily during low to medium tides, the time when the maximum number of seals hauled out in the San Francisco Bay region (Allen 1980, Fancher 1979, Risebrough 1978).

Survey periods were designed to last at least two hours, with counts occurring every half-hour. Each sub-site was surveyed separately, and added to other sub-sites making a grand total for the site. All sub-sites were visible from one location with the exception of Tomales Point and Tomales Bay. The Tomales Point and Tomales Bay sub-sites were a considerable distance from each other, and were usually counted twice during a survey.

For each sub-site, the observer recorded the total number of adult/immature seals, pups, dead pups, red-pelaged seals, and any fresh shark bitten animals present. Because of the difficulty in distinguishing adult from immature seals, these two groups were lumped together. Pups were the young of the year and difficult to distinguish after weaning from yearling seals. Consequently, pup numbers were reliable only between the first day of March and June. Red pelage results from the deposition of iron oxide precipitates on the hair shaft and usually extends from the head down to the shoulder (Allen et al. 1993).

Data are presented as maximum for the seasons, both breeding and molt. Summary statistics, including means and standard errors, are also provided for the breeding season 1997-2001 and the molt season 2000-2001.

All actual and potential disturbances to harbor seals were recorded. Actual disturbance was defined as any activity that resulted in behavior change by the seals such as moving towards or entering the water. Potential disturbance was defined as an activity that occurred within a ¼ mile area that had the potential to alter the behavior of the seals. For example, a plane flying below 1000 feet had the potential to disturb seals. Observers recorded the time, source of the disturbance, and the distance of the source from the seals. Distance measurement was not estimated consistently between sites or observers, and consequently was dropped from analyses. The seals' response to a disturbance was classified as no response, head alert, flush, flush into water or unknown (Allen et al. 1985). In the case of a flush or flush into water, the observer noted the number of seals that flushed, the number of pups that were left alone, and the number of seals that remained in place. After a flush into water, the time and location of where the seals rehauled were also recorded. In some cases, an unknown response was recorded if the disturbance occurred before the survey was started, and so the extent of the disturbance was not directly observed. An example would be a tight group of seals seen in the water off the haul out site and many fresh seal tracks on the haul out site.

Surveys in 1998 and 1999 incorporated seal numbers from a larger scale harbor seal census for the San Francisco Bay area and adjacent waters. Other regional haul out sites were Jenner, the Sonoma coastline, Sea Ranch, the San Mateo coastline, South Bean Hollow, the Fitzgerald Marine Reserve, the Richmond Bridge, Yerba Buena Island, and Mowry Slough (Figure 1b). Participants in the region-wide survey included the Gulf of the Farallones National Marine Sanctuary Association, San Francisco State University, and Stewards of Slavianka, a non-profit conservation group based in Sonoma County. Additionally, a region-wide aerial survey was conducted in May 1999 by NPS biologists on an airplane provided by the California Department of Transportation. Photographs (8x10" color prints) were taken of each site, and biologists from San Francisco State University counted seals from photographs.

Results

Overview

The population trend in harbor seals at Point Reyes appears stable between 1997 and 2001. Annual maximum counts for the breeding season ranged between 2,481 and 3,506, and annual average counts ranged from 1,744.6 and 2,511.1 (range of SE = 122.5 to 379.0; Table 1a-g). The lower numbers for maximum totals and annual averages were associated with the 1998 ENSO. The difference in the adult/immature population of harbor seals, excluding Duxbury Reef, was minimal between 1997 and 2001 (Lambda = +0.06) but the difference between the pup numbers was notable (Lambda = +0.27; Table 1a). The maximum numbers of adult/immature seals and pups were higher in 1997 and 2001 than those observed in 1998 (1998 Lambda = -0.46 and 2001 Lambda = +1.36). Pup and adult numbers were lower at all haul out sites in 1998. Maximum counts for the

molt also were reduced during the 1998 ENSO, and also in 1999 but not noteworthy. Similarly, maximum numbers during the breeding and molt seasons were stable by location (Tables 1b-g), except for 1998. The number of surveys in 1997 was insufficient in the molting season to report a maximum count. The number of red seals at Point Reyes is very low compared to San Francisco Bay, representing less than 5% of the population. Of note, though, was the larger number of red-pelaged seals in Drakes Estero, reaching a maximum of 27 in 1999 (Table1e). In general, far fewer red seals were observed at coastal haul out sites than the estuarine ones.

Regardless of year, most disturbances occurred at Drakes and Limantour Esteros, followed by Tomales Bay, and were induced by humans (Table 2a-e). Seal response to disturbance ranged from a simple head alert to flush into the water. By year, the percent of seals flushed into the water combining all sites ranged from 43% to 74% with the highest percentage of flushes occurring in 1997 (Tables 3a-e). The average disturbance per hour, combining all sites, for 2000 was 0.39 (SD = 0.63; n = 197) and for 2001 was 0.38 (SD = 0.94; n = 231; Table 4a-b). The highest number of disturbances per hour occurred at Drakes Estero/Limantour in 2000 (0.83 disturbances/hr) and at Tomales Bay in 2001 (1.3 disturbances/hr). People on foot were the major source for disturbance at Limantour Estero, and motorboats were for Tomales Bay. Motorboats were also a source for disturbance at Double Point due to commercial fishing near the haul out site (Table 2a-e). In general for all sites, seals were more disturbed on weekends (range 0.4-1.3 disturbances per survey) than weekdays (0.1-0.8 disturbances per survey; Table 4a-b). Double Point also had elevated disturbances in 2001 related to an aggressive male northern elephant seal (Table 5b). Bolinas Lagoon seals experienced elevated disturbances in 2001 related to non-motor boats, particularly kayaks (Table 9b).

Double Point

Double Point is a pocket beach marked by two prominent points and includes several subsites. Double Point is a primary pupping site at Point Reyes and numbers of pups and adults/immatures are fairly consistent during the breeding season from year to year. Surveyors counted seals at Double Point from 19 to 52 times per year between 1997-2001 (Table 5a). The highest total number of seals occurred between the last week of April and second week of May (Figure 2), ranging from 708-960. The maximum pup counts consistently occurred during the first week of May (Figure 3) ranging between 187 during 1998 to 416 in 2000. Pup counts in 1998 were nearly half of what occurred in 1997. The maximum counts during the molting season ranged between 677 and 1145 and occurred between early June and mid July (Figure 2); however, there was inconsistent coverage of the site in 1997. Seal numbers were low during the ENSO in 1998 and also during the molt in 1999.

Seals at Double Point usually were disturbed less often than at other haul out sites at Point Reyes, averaging from 0.2-1.0 disturbances per survey between 1997 and 2001 (Table 5a-d). Weekday disturbances were similar to weekend disturbances except in 2000 when disturbances reached 1.4 per weekend survey. The hourly average number of disturbances on weekends was 0.6 (SD=0.7, n=39) in 2000 and 0.3 in 2001 (SD = 0.4, n=13; Table 5d).

Sources for disturbance varied by year at Double Point (Table 5b). Overall, people on foot were the primary known source for disturbances (19%), although unknown sources disturbed seals (29%). Commercial fishing boats have increasingly disturbed seals over the past 3 years (13%) and an aggressive male northern elephant seal was the primary source for disturbance in 2001 (10%). When seals were disturbed at Double Point they were more likely to flush into the water, flushing > 50% of the times disturbed, regardless of year (Table 5c).

Drakes and Limantour Esteros

Drakes and Limantour Esteros consist of a number of tidal sandbars. This location is one of the primary pupping sites at Point Reyes. Seals were surveyed at Drakes and Limantour Esteros from 26 to 45 times per year between 1997-2001 (Table 6a). The highest total number of seals occurred between the first and second week of May (Figure 4). The maximum pup counts consistently occurred between the third week of April and the first week of May (Figure 5). The maximum counts during the molting season ranged between 817 and 1292 and occurred between mid June and mid July (Figure 4).

Seals at Drakes and Limantour Esteros were disturbed more than at any other haul out location at Point Reyes, averaging from 1.0-1.3 disturbances per survey between 1997 and 2001 (Table 6a-d). Weekday disturbances reached as high as 1.5 disturbances per day in 2000 but usually were around 0.9 disturbances per day; this contrasts to the regional maximum of 0.7. The hourly average number of disturbances was 0.8 (SD = 0.4, n = 18) in 2000 and 0.5 in 2001 (SD = 0.7, n = 21; Table 6d).

People on foot were the primary source for disturbance (47%), although unknown sources also disturbed seals (19%), as did birds (12%; Table 6b). Kayaks and motorboats are restricted in Drakes Estero during the breeding season and likely this explains the low rate of disturbance from these sources. When seals were disturbed at Drakes and Limantour Esteros, they were more likely to flush into the water, flushing > 50% of the times disturbed, regardless of year (Table 6c).

Tomales Point

Tomales Point consists of several subsites extending along the shoreline extending to Bird Rock. Tomales Point is one of the more difficult sites to survey because of distance to travel and weather. The area is consistently foggy during the spring and summer. Seals were surveyed at Tomales Point from 9 to 34 times per year between 1997-2001 (Table 7a). There was no consistency between years when the maximum adult/immature count occurred (Figure 6). The maximum pup counts occurred between the third week of April and the third week of May, except in 1997; however, the numbers ranged widely between 74 in 1998 to 194 in 2001 (Figure 7). The wide swing in numbers is likely related to both disturbance and seals shifting between nearby Tomales Bay, which also demonstrated coincidental swings in numbers. Seasonal molt counts are unreliable and spotty due to weather.

Seals at Tomales Point were disturbed moderately compared to other haul out sites at Point Reyes, averaging from 0.2-0.9 disturbances per survey between 1997 and 2001 (Table 7a-d). Weekend and weekday disturbances were more frequent in 2000 and 2001 than earlier years. The hourly average number of disturbances on weekends was 0.3 in 2000 (SD = 0.2, n = 13) and 0.4 in 2001 (SD = 0.4, n = 18; Table 7d).

People on foot were the primary source for disturbance (52%), although sport and commercial motorboats also disturbed seals (19%; Table 7b). Tomales Point is a popular sport abalone fishing area, and the sport-fishing season coincides with the harbor seal pupping season. When seals were disturbed at Tomales Point, the percentage of seals flushing into the water varied by year (Table 7c).

Tomales Bay

Tomales Bay consists of three haul out sites (Seal Island, Clam Island and Hog Island); however, seals infrequently haul out at Hog Island. Tomales Bay was surveyed from 9 to 34 times per year between 1997-2001 (Table 8a). The highest total number of seals occurred between late April and second week of May, ranging from 290 in 1998 to 625 in 1999 (Figure 8). The maximum pup counts ranged widely from year to year, ranging from 34 in 1998 to 190 in 1999; however, coverage of the site was spotty due to logistics and weather (Figure 9). The maximum counts during the molting season were more consistent, ranging between 290 and 347 (Figure 8).

As with Drakes Estero, there were a larger number of red seals than occurred in the outer coastal areas with a maximum of 17 observed in 1999 and 2000 (Table 8a).

Recreational activities in Tomales Bay are numerous, and seal use of Hog Island has declined dramatically over the past 15 years. Nevertheless, disturbances per survey only ranged from 0-1.5 between 1997 and 2001 (Table 8a). Weekend disturbances were higher in 2000 and 2001 than during weekdays. Weekend disturbances were 0.4 disturbances per hour in 2000 (SD = 0.6, n = 13) and 1.3 in 2001 (SD = 2.5, n = 19; Table 8d).

People in motorboats were the primary source for disturbance (52%), although recreational clam diggers also disturbed seals (13%; Table 8b). Up to 1000 people were present at a time digging for clams during low tide cycles on the weekends; however, the NOAA SEALS program reduced disturbance by clam diggers with an onsite education program. The main seal haul out area is near the primary access channel for boats in the bay, and so recreationists are naturally attracted to the seals hauled out. When seals were disturbed at Tomales Bay, they were less likely to flush into the water, flushing < 55% of the times disturbed, regardless of year (Table 8c).

Bolinas Lagoon

The Bolinas Lagoon location consists of several tidal sand bars. Seals were surveyed at Bolinas Lagoon from 3 to 35 times per year between 1997-2001 (Table 9a). The maximum counts at Bolinas were distributed throughout the breeding season in contrast to other colonies, but during the molt season a distinct peak occurred during the first two weeks of July, ranging from 267 to 401 (Figure 10). The maximum pup counts consistently occurred between the first and second week of May, excluding 1997, and ranged from 51 to 123 (Figure11). This colony is the only one that appears to be growing; pup production more than doubled in three years between 1999 and 2001. As with all sites, pup production was down during 1998, and numbers of seals hauled out were also reduced.

Seals at Bolinas Lagoon were disturbed moderately in comparison to other haul out sites at Point Reyes, averaging from 0 to 1.1 disturbances per survey between 1997 and 2001 (Table 9a-d). Weekend and weekday disturbances varied from year to year. The hourly average number of disturbances on weekends was 0.3 (SD = 0.4, n = 9) in 2000 and 0.6 in 2001 (SD = 0.5, n = 18; Tables 9d). The NOAA SEALS program reduced disturbance by recreationists with an onsite education program starting in 1997.

Kayaks were the primary source for disturbance (24%), although unknown sources also disturbed seals (24%), as did birds (18%; Table 9b). When seals were disturbed at Bolinas Lagoon, they were more likely to flush into the water, flushing > 50% of the times disturbed, most years (Table 9c).

Duxbury Reef

Duxbury Reef was added as a survey site in 1999. This site is adjacent to Bolinas Lagoon and often serves as an alternate site to those in the Lagoon. Seals were surveyed from 8 to 32 times between 1999 and 2001 (Tables 10a). Annual maximum ranged from 71 to112 (Figure 12) including from 10 to 20 pups during the breeding season (Figure 13). We had insufficient data during the molt until 2001 when the maximum count was 99 (Figure 12).

Seals were rarely disturbed at Duxbury Reef, likely due to the difficulty of accessing the site except at very low tides. Humans on foot were the primary source for disturbance (88%; Table 10b). During the weekends, disturbances averaged 0.3 per hour (SD = 0.8, n = 7) in 2000 and 0.4 per hour (SD = 1.1, n = 17) in 2001 (Table 10d).

Point Reyes Headland

Point Reyes Headland location consists of a series of pocket beaches that is used also by a large northern elephant seal colony. As with Tomales Point, surveys at Point Reyes Headland were limited due to weather conditions. Annual surveys ranged between 7 and

31 (Tables 11a); several scheduled surveys were canceled on foggy days. Annual maximum counts during the breeding season ranged between 131 and 168 between 1997 and 2001 (Figure 14). Point Reyes Headland is not a significant pupping site, and the maximum pup counts ranged between 24 and 51 (Figure 15). During the molt, seal numbers were much higher, ranging between 276 and 466, because this site is used more by migrating harbor seals (Figure 14; S. Allen, pers. obs.).

Point Reyes Headland is the most remote and least disturbed site at Point Reyes, with annual disturbance days ranging between 0.0 and 0.1, regardless of day of week. The average hourly disturbance rate in 2000 on weekdays was 0.04 (SD=0.1, n=19) and in 2001 on weekends was 0.04 (SD=0.07, n=8, Table 11d).

Motorboats (40%) and planes (40%) were the only sources for disturbance (Table 11b). Nevertheless, seal spatial use of the site has changed significantly over the past 20 years as the northern elephant seal colony has grown.

San Francisco Bay Area Survey

Summary of harbor seal surveys for the San Francisco Bay Area and adjacent waters are summarized in Tables 12a-b. The maximum total harbor seal count during the 1998 breeding season was 2,595 seals on 6 May and the maximum pup count was 485. During the molting season, 3,235 seals were counted on 28 June 1998. The average maximum count for the region, combining both seasons was 2,467.0 (n=5, x=2,467, SD=507.6; Table 12a). In 1999 the highest count for all sites occurred during the aerial survey on May 10 with 3,634, including 876 pups. During the molting season, 3,011 seals were counted on 17 July 1999. The average regional count combining breeding and molt seasons in 1999 was 2,272.2 (n=9, SD=670.8; Table 12b). Three sites (Double Point, Drakes and Limantour Esteros and Tomales Point) accounted for the majority of the total number of seals (69.6%) and pups (79.2%) counted in 1998, but in 1999, Double Point, Drakes and Limantour Esteros and Tomales Bay accounted for the majority of the total count (60%) and of the pup count (62%). This change implied a shift of seals from Tomales Point to Tomales Bay in 1999.

Regional surveys for 2000 through 2001 were summarized in the NOAA annual reports (see Mortenson et al. 2000 and 2001).

Unusual Mortality Event

During the 1997 breeding and molt seasons, biologists and park visitors identified dead adult and immature harbor seals in Point Reyes. Tomales Bay was the first location where a sick adult seal was picked up by the Marine Mammal Center (TMMC, F. Gulland, pers. com.). Reports of dead and dying seals were next recorded at Double Point and Bolinas Lagoon in April and May and then at Drakes/Limantour Esteros and Point Reyes Headland from June through August. The NMFS Stranding Network (Point Reyes National Seashore, unpubl. data) documented a total of 91 dead seals. Of those seals that were identified by sex and age, the majority of seals were adults (79%; AD =

72, SA = 7, PUP = 7, UNK = 5), and of those identified to sex, the majority was males (33%; M = 30, F = 17, UNK = 44). Tissues were collected from several fresh dead or dying seals by the TMMC. A fibrinous hemorrhagic pneumonia with marked bacterial colonization was evident in all of the fresh specimens. The lesions resembled that of acute *Pasteurella* pneumonia in cattle, which is often predisposed by viral infection (L. Lowenstine, U.C. Davis, pers. com.). Nineteen live harbor seals were subsequently captured at Point Reyes Headland and blood was taken for further analyses. Preliminary findings indicate the presence of antibodies to a previously unidentified virus (F. Gulland, pers. com.).

In 2000, another unusual stranding event occurred at Point Reyes, and was investigated by the stranding network including TMMC, Museum of Vertebrate Zoology Berkeley and the National Park Service. The epicenter of this event was Tomales Point haul out sites where around 25 dead seals were found. Tissues, blood and urine were collected from five very fresh specimens. All seals tested negative for biotoxins or morbillivirus. *Pseudomonas* bacteria were found in all specimens, and an unidentified virus was found in one very fresh (<2 hrs dead) specimen. Preliminary evidence indicated that seals died acutely, since blubber layers were normal; lymph nodes were engorged with fluid (F. Gulland, Marine Mammal Center, unpubl. data).

Discussion

Harbor seals in central California represent a significant proportion of the state population. Surveys of harbor seals in the San Francisco Bay Area and adjacent waters in 1998 and 1999 reveal that large numbers of harbor seals are concentrated in north-central California, particularly at Point Reyes. Double Point and Drakes/Limantour Esteros account for more than 50% of total seals in Point Reyes counted during both the breeding and molt seasons. The pups produced at these two sites accounted for more than 55% of the total pups produced at Point Reyes annually. Substantial numbers of seals also haul out in small groups along the Sonoma and San Mateo counties' coastline and in San Francisco Bay.

Surveys conducted at Point Reyes between 1997 and 2001 showed annual differences, likely related to the 1998 El Nino event. However, trends may also reflect increased effort between years as the volunteer monitoring program was fully implemented. In addition, there was not consistent effort between weekend and weekday surveys. This is important in analyzing the disturbance data, since we would expect more disturbances on weekends when recreational use is higher.

Nonetheless, significantly fewer seals were breeding in 1998 than 1997 (-24%). Pup production was also lower, (-46%). Factors potentially influencing the breeding population at Point Reyes between 1997 and 1998 were the harbor seal die off during and after the breeding season of 1997 and the 1998 El Nino event. The 1999 number of seals breeding was substantially higher than that of 1998 but only slightly higher than the 1997 breeding season. Pup production was also elevated from 1998 by 49%, but only by 8% from the 1997 season. El Nino effects were also documented in other pinnipeds in

California in 1998 (DeLong et al. 1999); however, no other unusual stranding event was noted for harbor seals in California in 1998 (J. Cordaro, NMFS, pers. com.).

Although disturbances were recorded at all colonies, Drakes and Limantour Esteros had the highest number of disturbances recorded, regardless of year. Nevertheless, the site remained one of the largest colonies in the region, accounting for 29% of the total number of seals counted in 2001. Humans mostly caused disturbances but the type of disturbance varied by location. Boats were the primary cause for disturbance to seals in Tomales Bay but humans on foot were in Drakes/Limantour Esteros. In 1998 the Lawson Landing barge that transported more than 100 people at a time to dig for clams in Tomales Bay was terminated. The number of seals using the bay increased in 1999 from the 1997 (+18%) and 1998 (+116%) maximum numbers. The Farallones Sanctuary SEALS program had implemented a protection program for the seals to educate the public and divert clam diggers from the resting seals, and likely the combination of reduced usage and education by the SEALS program contributed to the increased presence of seals in Tomales Bay.

The occurrence of the two unusual stranding events within this five-year monitoring period is of particular interest. The only other mass stranding event of harbor seals in California was noted in 1985 at Drakes Estero and Double Point. A virus was also noted as the likely cause for that stranding event (S. Allen, pers. com.). No other stranding event for harbor seals has been documented in California over the past 20 years (J. Cordaro, NMFS, pers. com.).

The long-term monitoring program for harbor seals of Point Reyes has provided important information to guide management. Actions guided by the results of these surveys have included:

1) The initiation of a baseline study of diseases in harbor seals in conjunction with the Marine Mammal Center;
2) Continued annual restriction of kayaks and other watercraft in Drakes Estero during the breeding season March 15 - June 30;
3) A study of the dispersal of weaned pups and the feeding habits of harbor seals at Point Reyes in collaboration with Moss Landing Marine Lab;
4) Proposed delineation of marine protected areas at Point Reyes.

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and abundance of common seals, *Phoca vitulina*, in Orkney. Unpubl. Ph.D. Dissert., Univ. of Aberdeen, England. 167pp.

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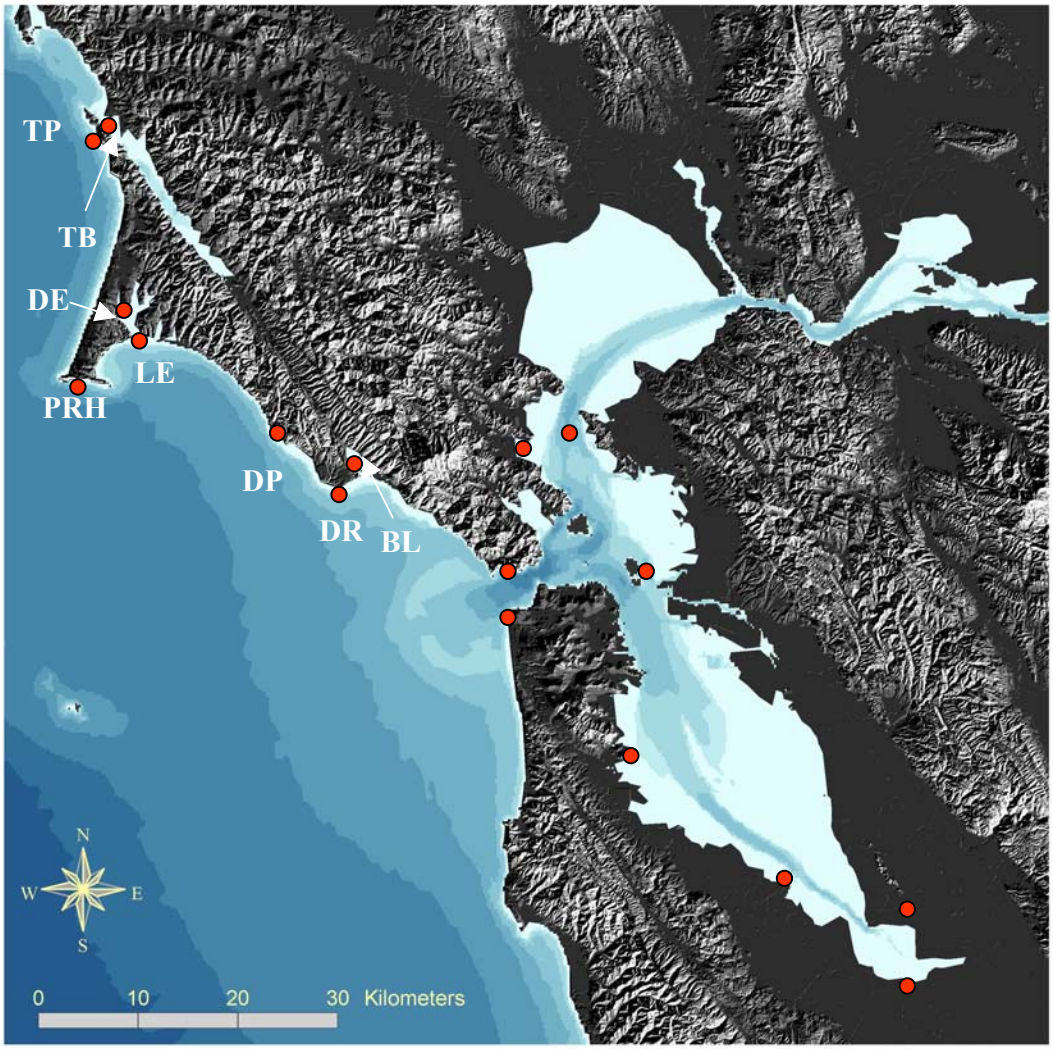

Figure 1a. Harbor seal haul out sites at Point Reyes and adjacent areas.

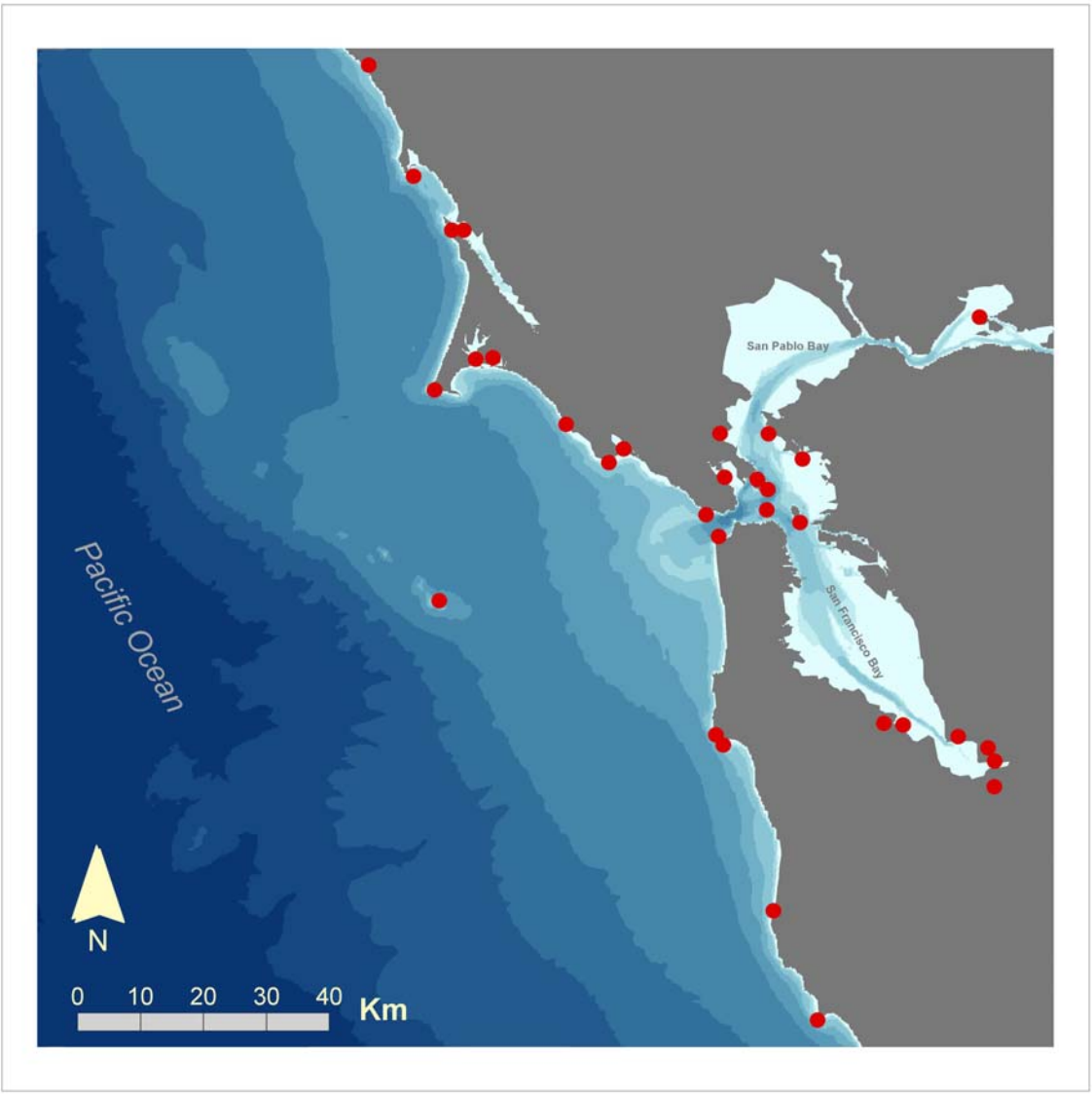

Figure 1b. Harbor seal haul out sites in central California.

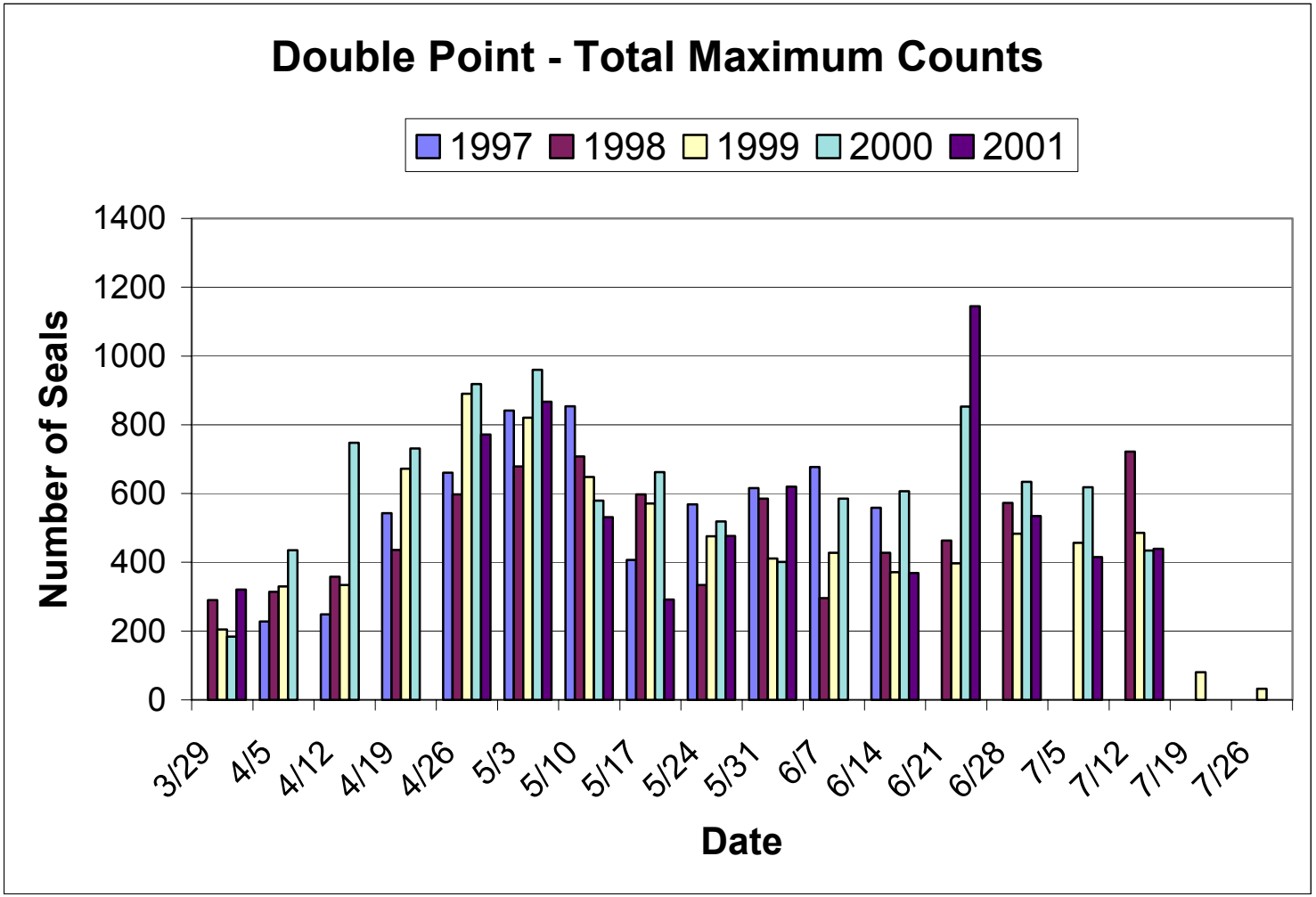

Figure 2. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

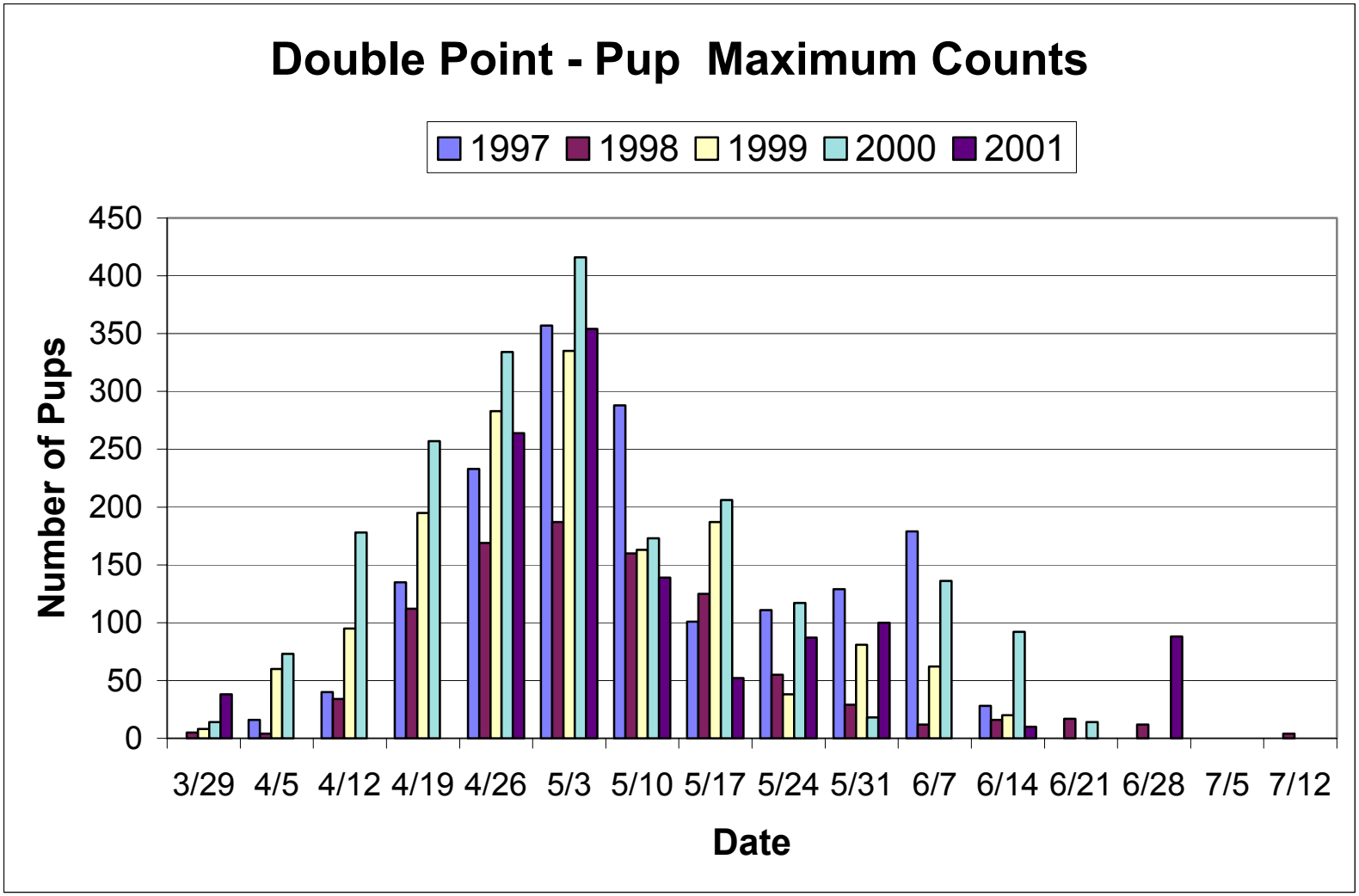

Figure 3. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

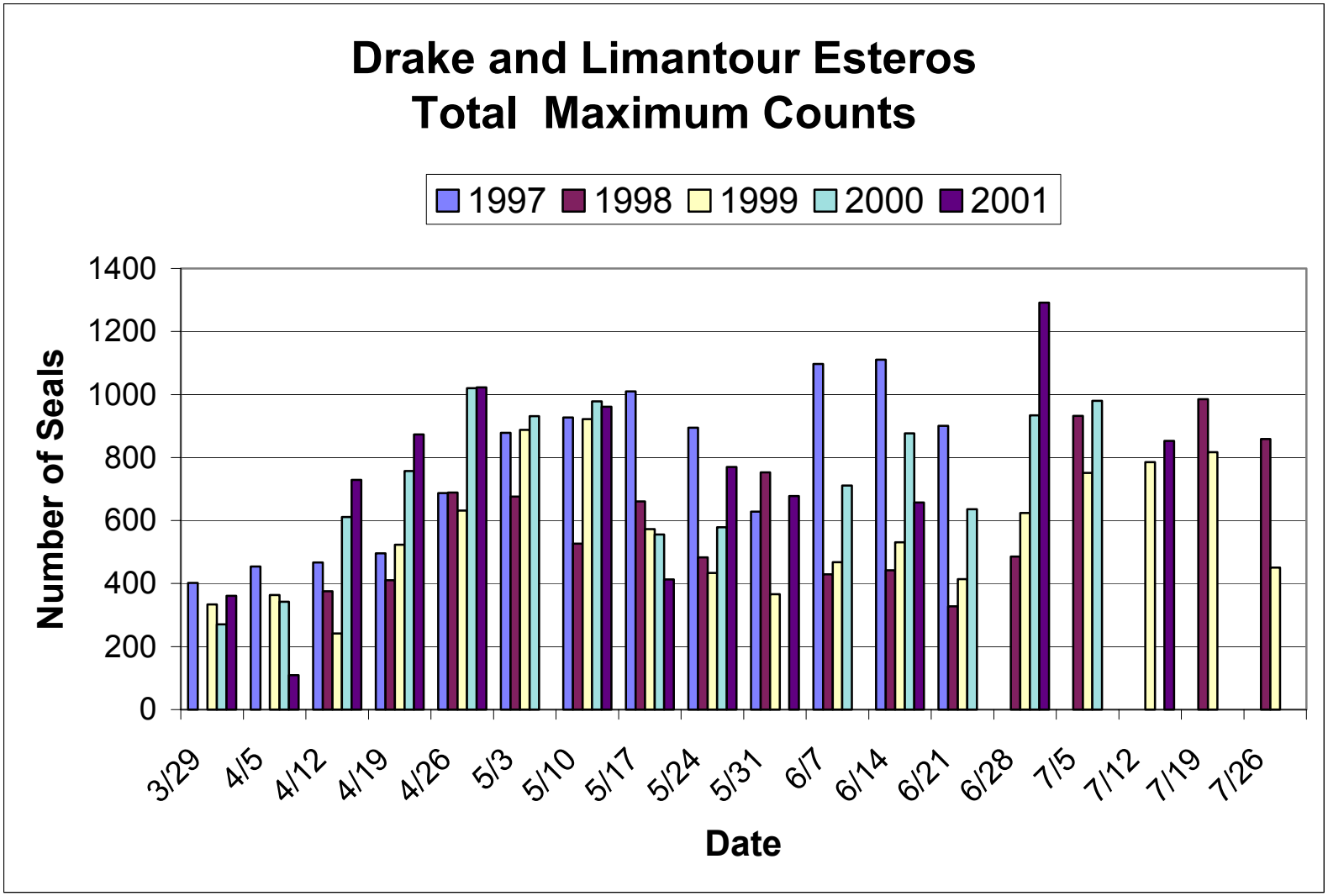

Figure 4. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

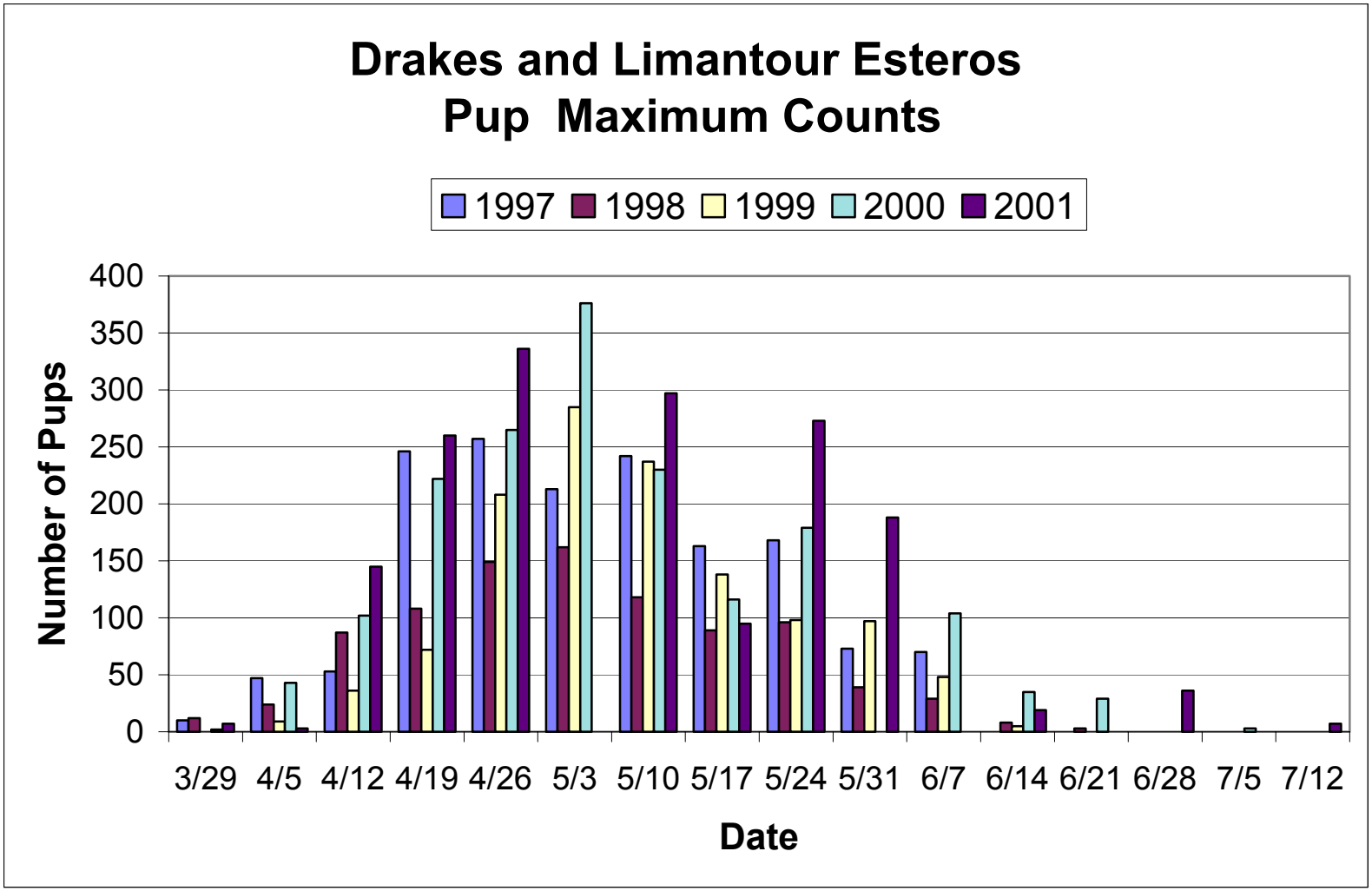

Figure 5. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

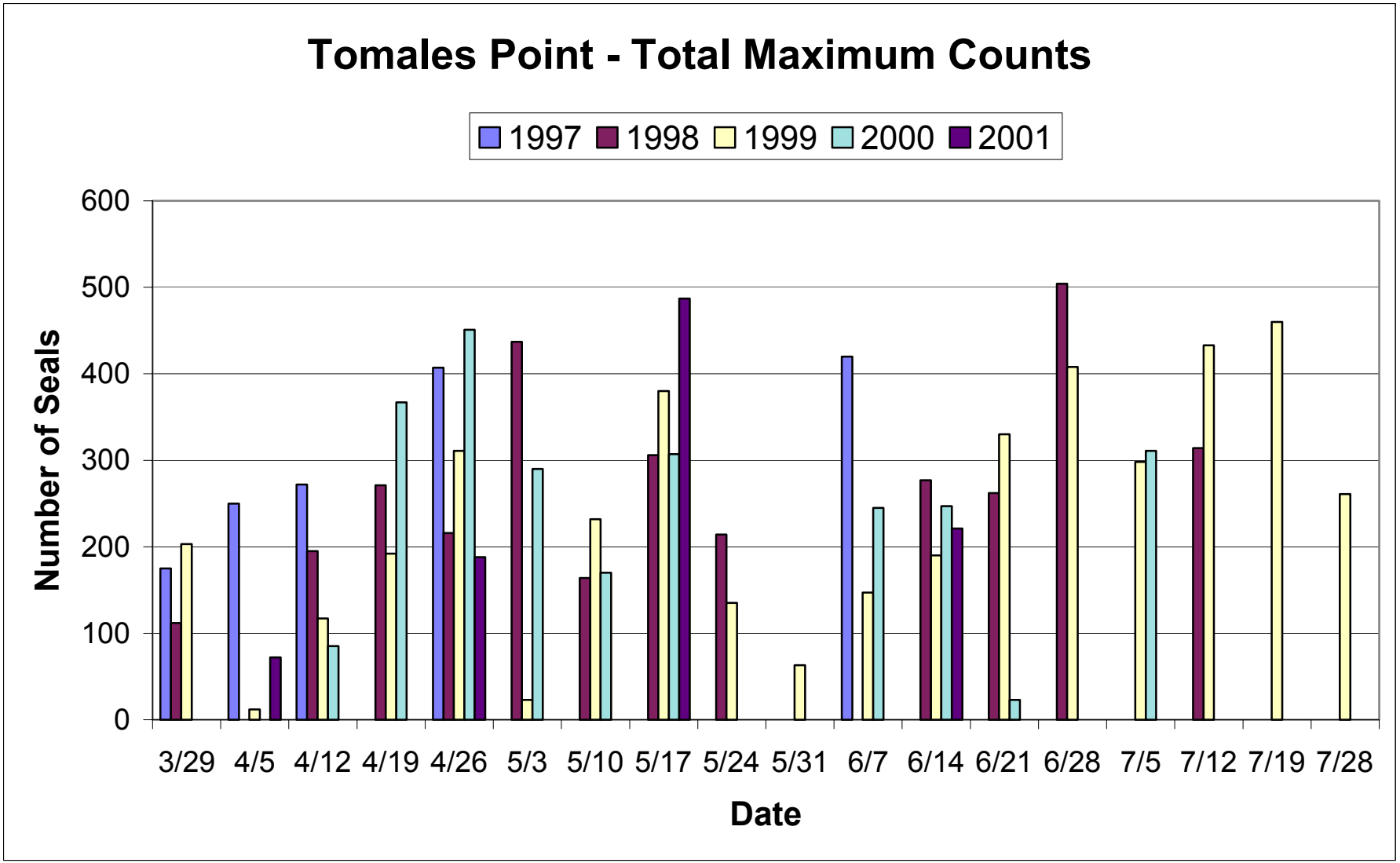

Figure 6. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

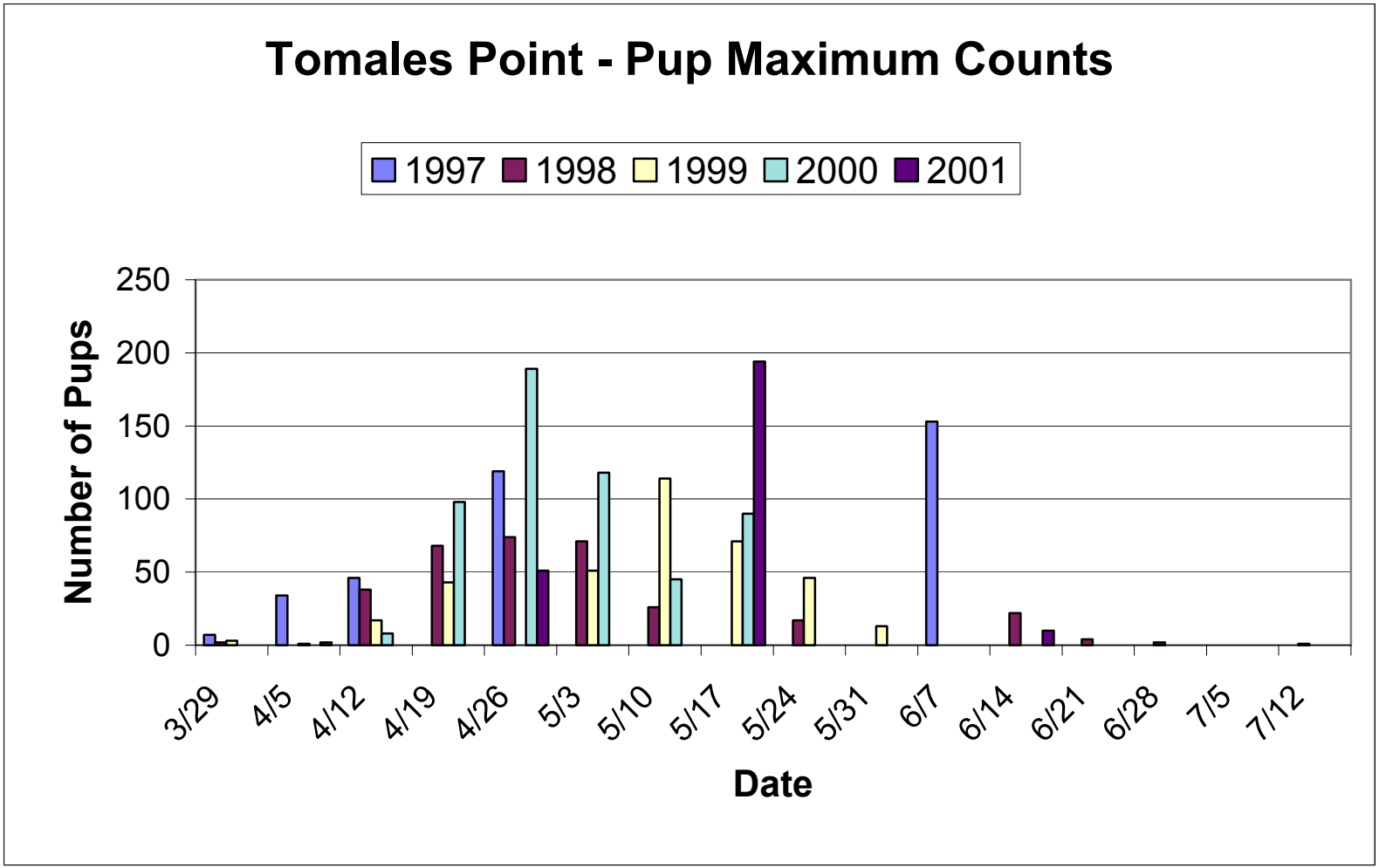

Figure 7. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

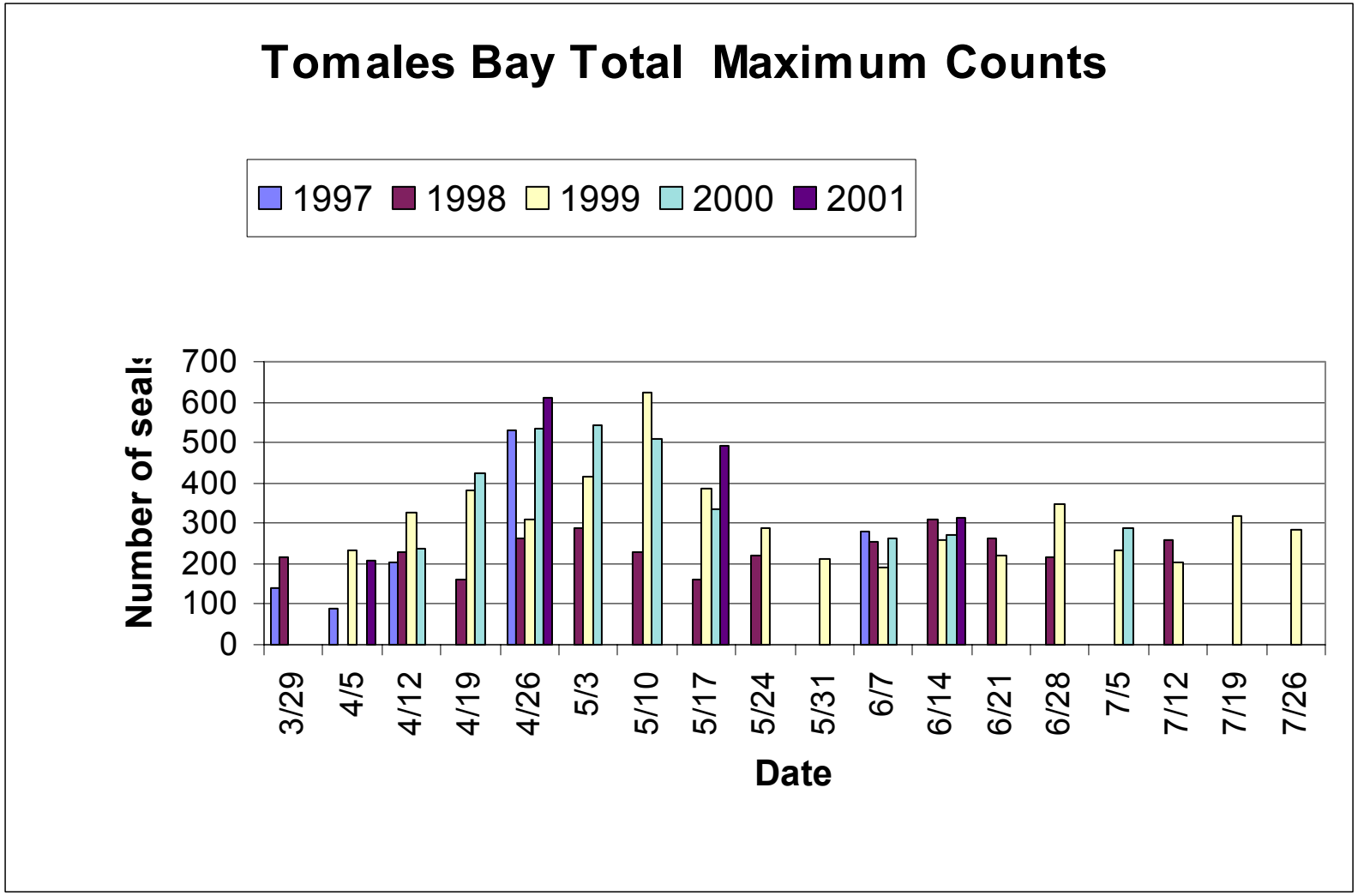

Figure 8. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

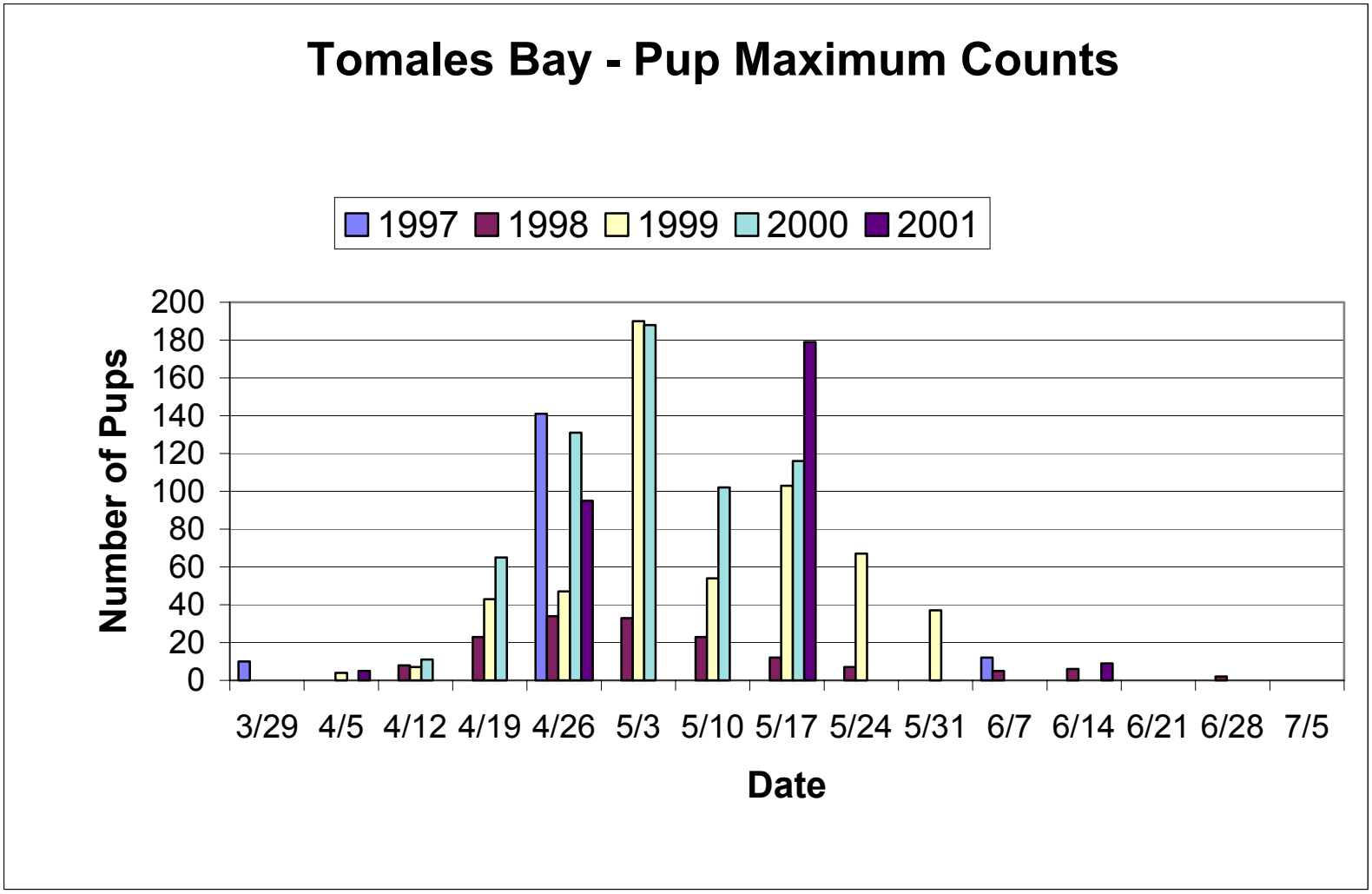

Figure 9. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

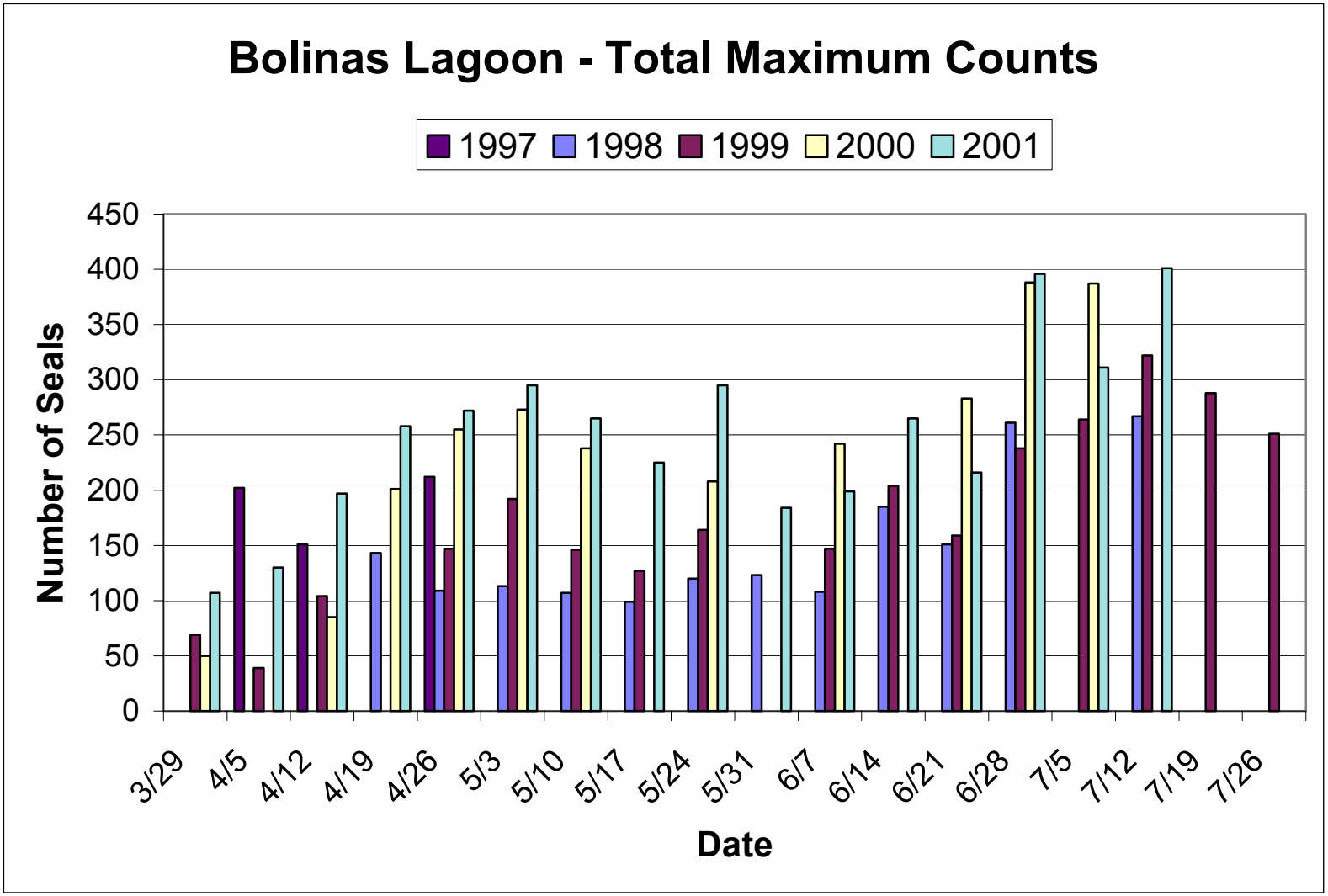

Figure 10. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

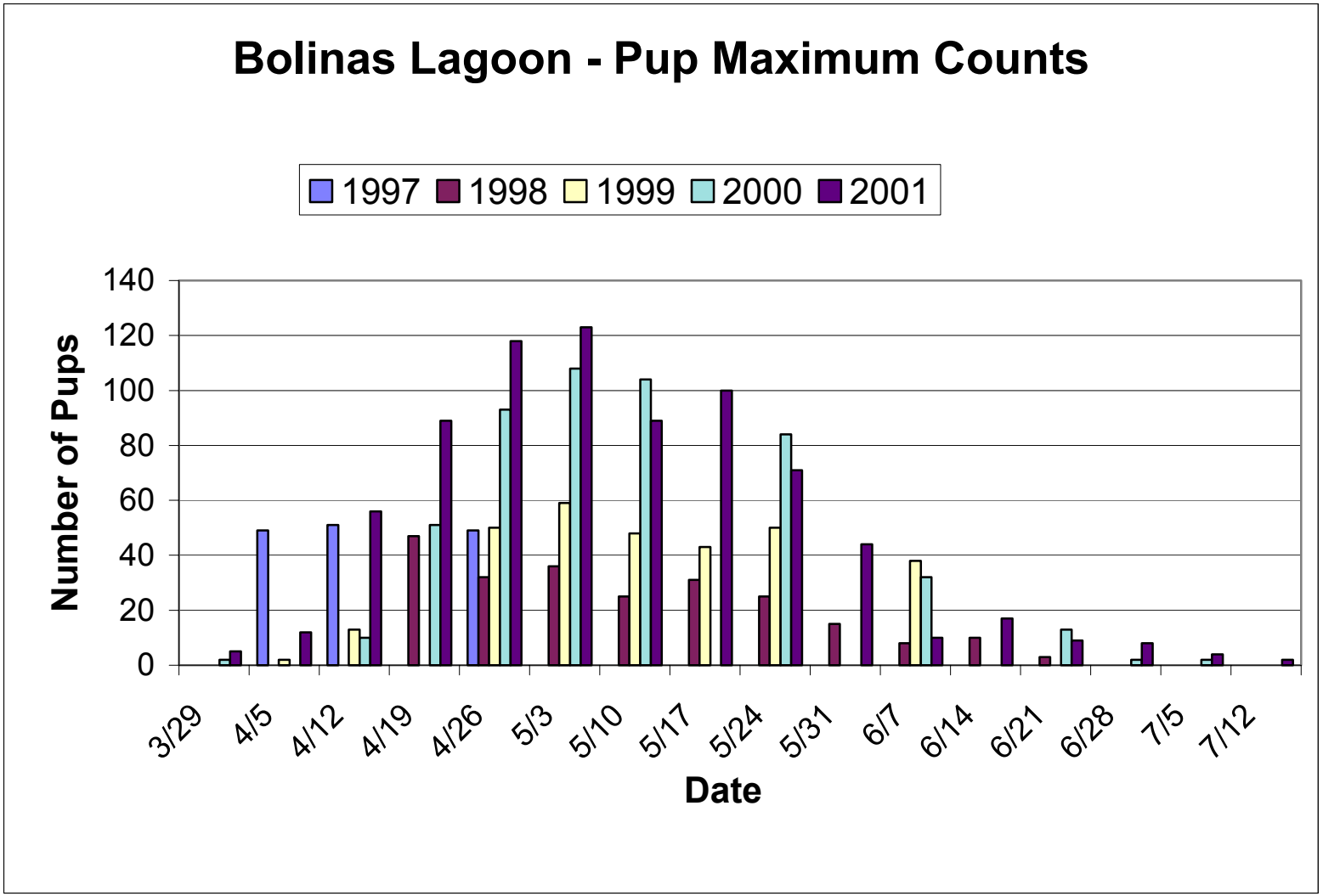

Figure 11. Weekly maximum number of harbor seal pups during the 1997-2001 breeding seasons. See text for methods.

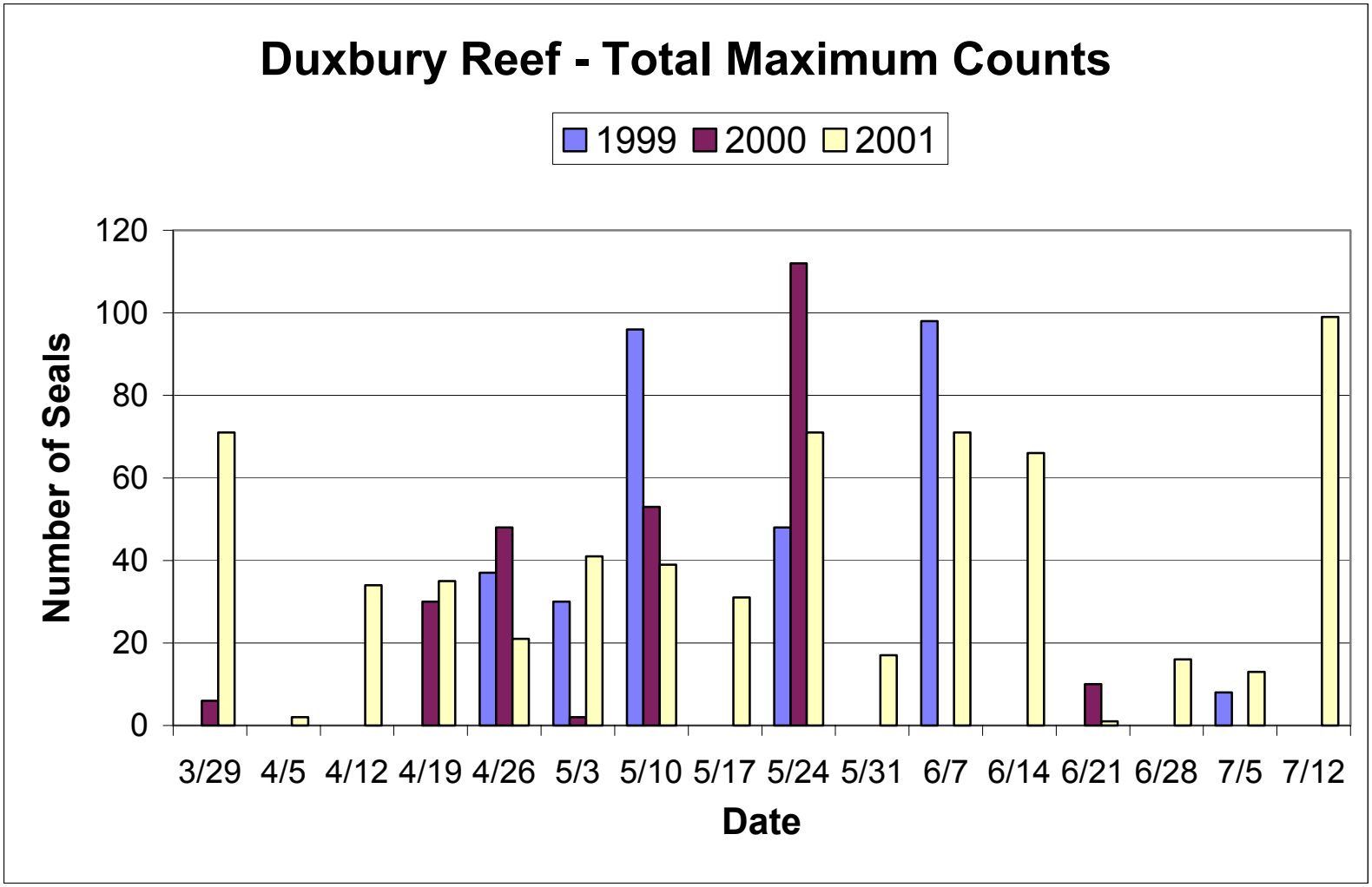

Figure 12. Weekly maximum harbor seal counts, combining all age classes, 1999 - 2001. See text for methods.

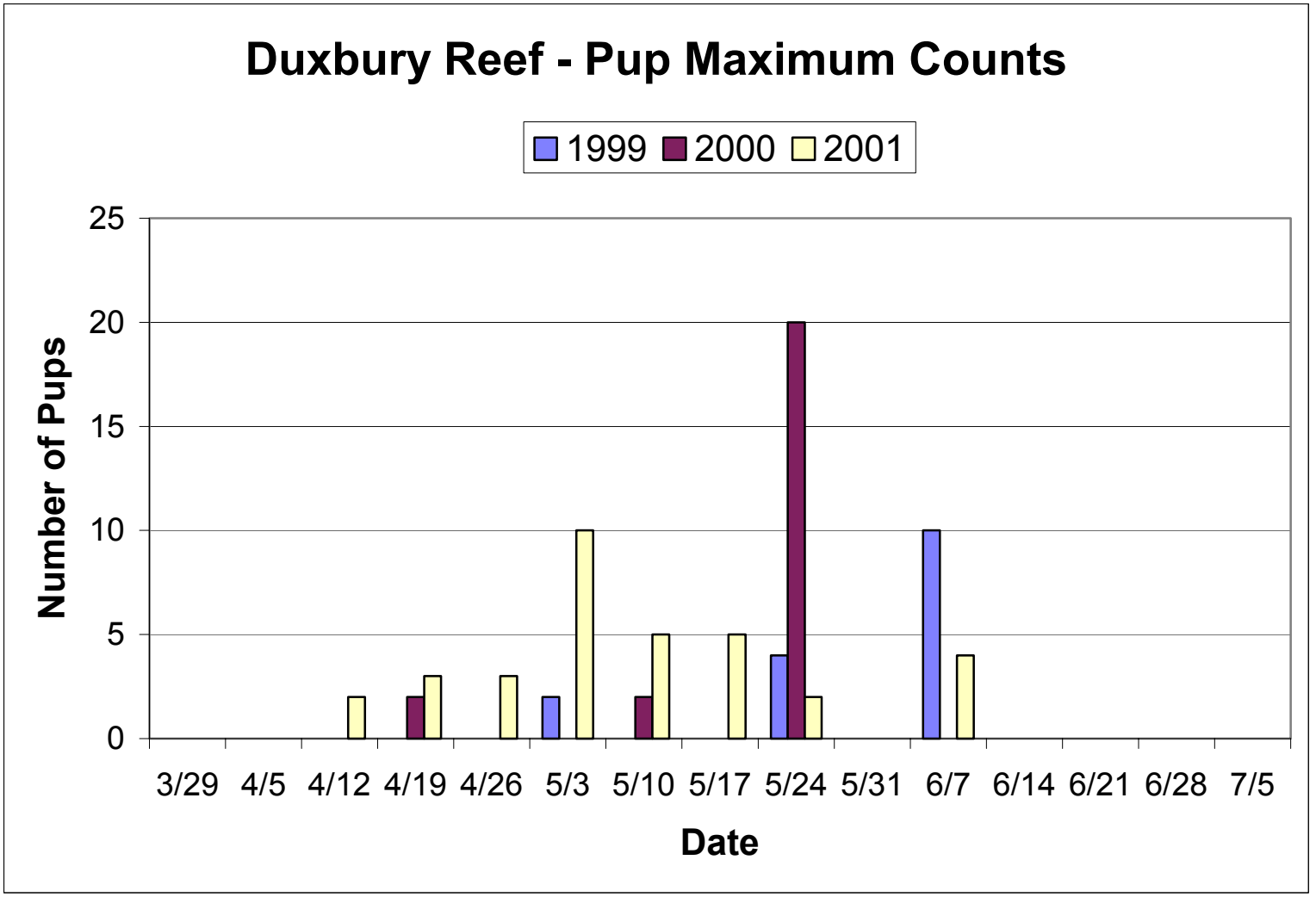

Figure 13. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

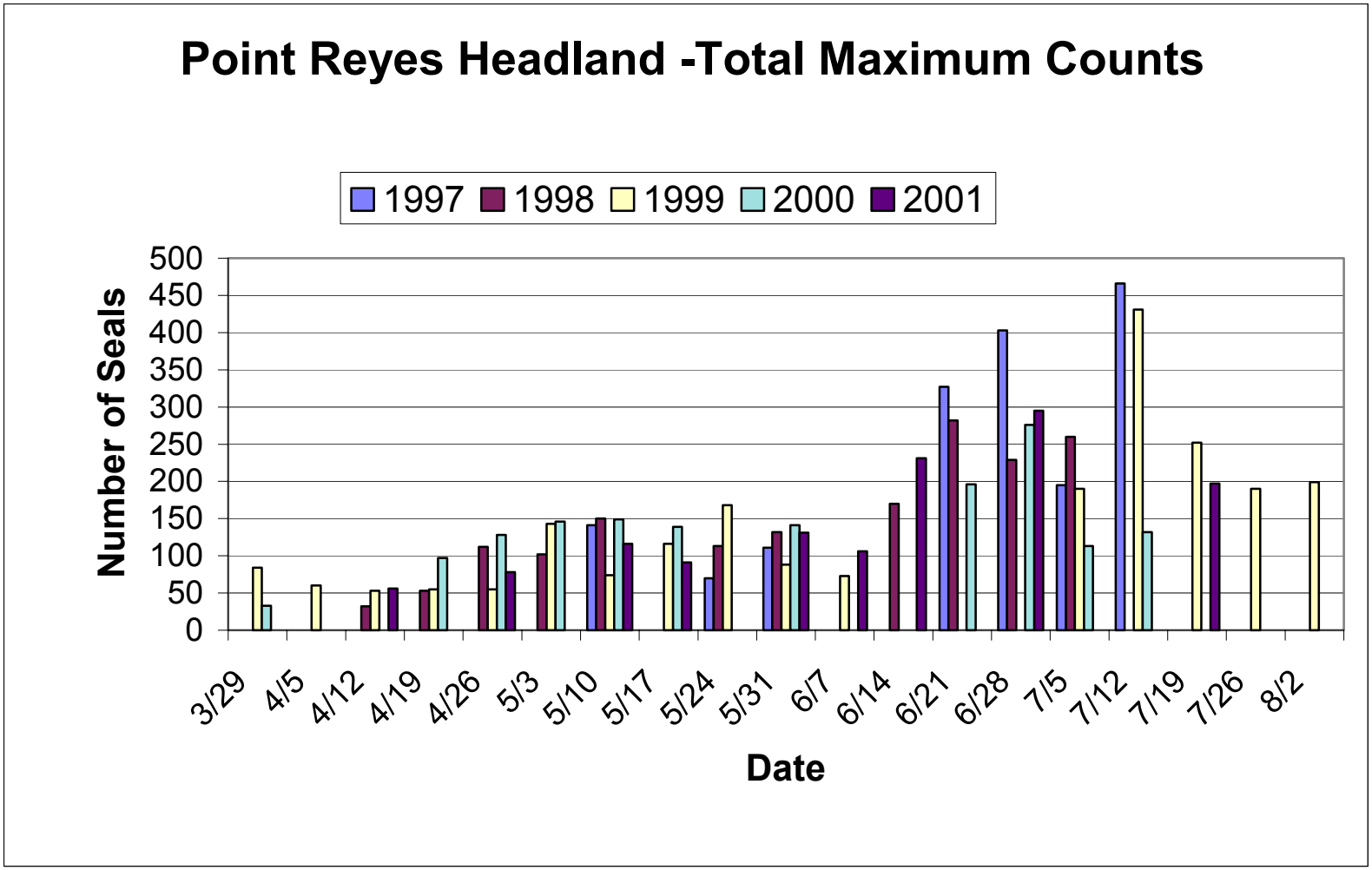

Figure 14. Weekly maximum harbor seal counts, combining all age classes, 1997 - 2001. See text for methods.

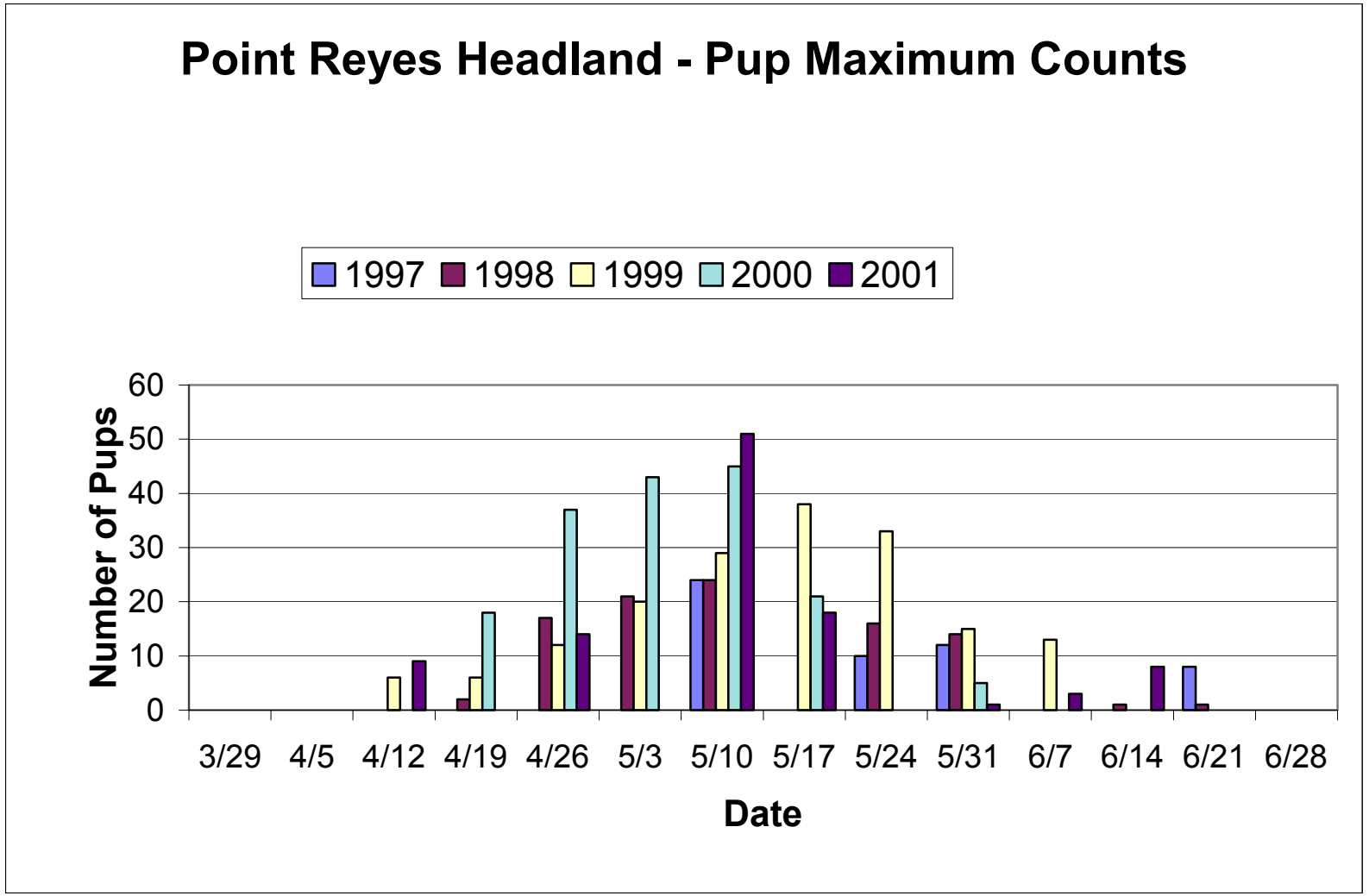

Figure 15. Weekly maximum number of harbor seal pups during 1997-2001 breeding seasons. See text for methods.

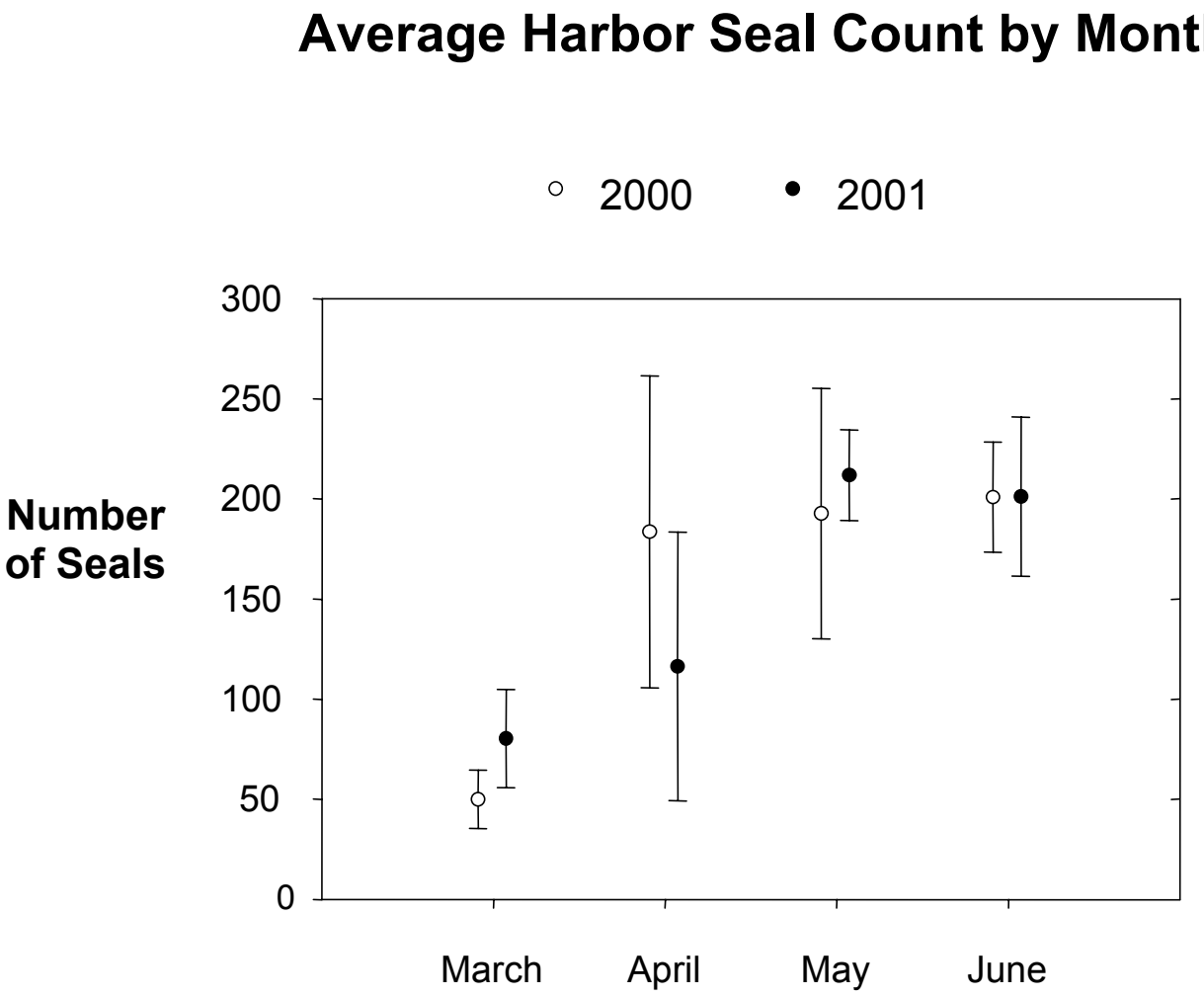

Figure 16. Harbor seal average count and standard deviation, combining all age classes and all sites, by month during the breeding season for 2000 and 2001.

Table 1a. Summary of the survey data for the1997-2001 seasons, combining all sites at Point Reyes. Maximum # of Breed and Molt, and Average Breed include all age classes.

YEAR	Max # Breed	Average Breed	Max # Pups	Max # Molt	#Surveys	# Disturbances	Disturbances Per Survey	Dead Pups
1997	3,268	1,830.5 SE = 379 N =4	983	NA	Weekday: 44 Weekend: 29 Total: 73	Weekday: 9 Weekend: 37 Total: 46	0.2 1.3	7
1998	2,481	1,744.6 SE = 122.5 N = 8	528	3,070	Weekday: 79 Weekend: 64 Total: 143	Weekday: 24 Weekend: 46 Total: 70	0.3 0.7	15
1999	3,325	1,779.9 SE = 173.5 N = 10	1,068	2,863	Weekday: 139 Weekend: 69 Total: 208	Weekday: 71 Weekend: 54 Total: 125	0.5 0.8	9
2000	3,506	2,511.1 SE = 224.4 N = 7	1,342	3,108	Weekday: 106 Weekend: 91 Total: 197	Weekday: 78 Weekend: 116 Total: 194	0.7 1.3	11
2001	3,485	2,218.8 SE = 244.8 N= 4	1,247	3,769	Weekday: 112 Weekend: 119 Total: 231	Weekday: 57 Weekend: 107 Total: 164	0.5 0.9	7

Table 1b. Summary of the average number of adult/immature seals combining the breeding and molting seasons at Point Reyes, California, 1997-2001, by location; SE = standard error and N= sample size.

Year	Double Point	Drakes Estero & Limantour	Tomales Point	Tomales Bay	Bolinas Lagoon	Point Reyes Headland
1997	564.0	754.3	304.8	241.0	188.3	107.3
SE	62.0	75.8	47.3	99.0	18.9	20.57
N	11	12	5	4	3	3
1998	468.7	453.9	243.6	233.8	123.0	108.0
SE	44.99	70.9	31.4	15.2	8.8	16.4
N	12	12	9	10	9	8
1999	513.1	523.1	167.1	329.4	133.9	88.09
SE	60.5	60.5	31.65	36.8	16.3	11.6
N	12	12	12	11	10	11
2000	636.1	693.9	270.3	389.8	194.0	119.0
SE	59.9	75.3	39.9	45.3	28.9	15.79
N	12	11	8	8	8	7
2001	**531.1**	**657.4**	**242.0**	**406.3**	**224.3**	**115.6**
SE	**74.3**	**90.6**	**87.7**	**89.88**	**17.9**	**21.4**
N	**8**	**10**	**4**	**4**	**12**	**7**

Table 1c. Survey summary data for 1997. All reported numbers reflect the maximum number seen during a single census over the entire season. The percent of red seals is a percentage of the maximum total number of seals during the breeding season. Max # Breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt =all age classes during the molting season, June 15 to July 15. NA = data not available.

	Max # Breed	Max # Pups	Max # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
Double Point	854	357	NA	Weekday: 12 Weekend: 7	Weekday: 4 Weekend: 6	11	1.3%	3	3
Drakes Estero & Limantour	1111	257	NA	Weekday: 10 Weekend: 16	Weekday: 3 Weekend: 30	13	1.2%	3	1
Tomales Point	420	153	NA	Weekday: 8 Weekend: 1	Weekday: 2 Weekend: 1	3	0.7%	2	1
Tomales Bay	530	141	NA	Weekday: 8 Weekend: 1	Weekday: 0 Weekend: 0	14	2.6%	0	1
Bolinas Lagoon	212	51	NA	Weekday: 1 Weekend: 2	Weekday: 0 Weekend: 0	5	2.4%	0	1
Point Reyes Headland	141	24	466	Weekday: 5 Weekend: 2	Weekday: 0 Weekend: 0	0	0%	NA	0
1997 Total	3268	983	NA	73	46	-	-	-	-

Table 1d. Summary data for 1998. All reported numbers reflect the maximum number seen during a single census over the entire season. The percent of red seals is a percentage of the maximum total number of seals during the breeding season. Max # Breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt =all age classes during the molting season, June15 to July 15.

	Max # Breed	Max # Pups	Max Molt #	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
Double Point	708	187	722	Weekday: 18 Weekend: 12	Weekday: 1 Weekend: 5	6	0.8%	6	6
Drakes Estero & Limantour	753	162	985	Weekday: 11 Weekend: 18	Weekday: 8 Weekend: 24	22	2.9%	2	1
Tomales Point	437	74	504	Weekday: 13 Weekend: 16	Weekday: 3 Weekend: 6	5	1.1%	3	3
Tomales Bay	290	34	310	Weekday: 12 Weekend: 14	Weekday: 7 Weekend: 11	8	2.8%	2	1
Bolinas Lagoon	143	47	267	Weekday: 12 Weekend: 0	Weekday: 5 Weekend: 0	8	5.6%	2	1
Point Reyes Headland	150	24	282	Weekday: 13 Weekend: 4	Weekday: 0 Weekend: 0	4	2.7%	1	3
1998 Total	2481	528	3070	143	70	-	-	-	-

Table 1e. Summary data for 1999 season. All reported numbers reflect the maximum number seen during a single census over the entire season. The percent of red seals is a percentage of the maximum total number of seals during the breeding season. Max # Breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max #Molt =all age classes during the molting season, June15 to July 15.

	Max # Breed	Max # Pups	Max # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
Double Point	890	335	486	Weekday: 23 Weekend: 13	Weekday: 11 Weekend: 10	11	1.2%	4	5
Drakes Estero & Limantour	922	285	817	Weekday: 26 Weekend: 19	Weekday: 24 Weekend: 35	27	2.9%	4	2
Tomales Point	430	151	460	Weekday: 19 Weekend: 15	Weekday: 5 Weekend: 0	10	2.3%	3	1
Tomales Bay	625	190	347	Weekday: 19 Weekend: 15	Weekday: 11 Weekend: 4	17	2.7%	1	1
Bolinas Lagoon	192	59	322	Weekday: 18 Weekend: 2	Weekday: 18 Weekend: 4	7	3.6%	0	0
Duxbury Reef	98	10	NA	Weekday: 7 Weekend: 1	Weekday: 0 Weekend: 1	1	1.0%	0	0
Point Reyes Headland	168	38	431	Weekday: 27 Weekend: 4	Weekday: 2 Weekend: 0	2	1.2%	0	0
1999 Total	3325	1068	2863	208	125	-	-	-	-

Table 1f. Summary data for 2000. The maximum numbers were seen during a single census over the entire season. Max # Breed = adults, immatures and pups during the breeding season, March 15 to June 15, recorded by observers with 2 or more years of experience. Avg # Breed= adults, immatures and pups during the breeding season, March 15 to June 15, recorded by observers of all experience levels. Max # Molt =all age classes during the molting season, June 15 to July 15, recorded by observers with two or more years of experience. Avg # Molt = all age classes during the molting season, June 15 to July 15, recorded by all observers. se =standard error

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	#Disturbances	Red Seals	Shark Bites	Dead Pups
Double Point	960	507.70 se 40.24	416	853	657.28 se 57.39	Weekday: 24 Weekend: 28	Weekday: 12 Weekend: 39	5	4	5
Drakes Estero & Limantour	1020	525.43 se 44.06	376	980	740.83 se 100.58	Weekday: 27 Weekend: 18	Weekday: 43 Weekend: 38	11	2	1
Tomales Point	451	206.41 se 30.42	189	311	210.33 se 40.61	Weekday: 14 Weekend: 13	Weekday: 12 Weekend: 11	5	1	0
Tomales Bay	541	354.75 se 31.40	188	290	280.50 se 6.10	Weekday: 12 Weekend: 13	Weekday: 5 Weekend: 19	17	0	2
Bolinas Lagoon	273	163.10 se 31.41	108	388	352.66 se 35.48	Weekday: 6 Weekend: 9	Weekday: 4 Weekend: 7	9	1	2
Duxbury Reef	112	31.66 se 12.01	20	10	5.00 se 5.05	Weekday: 4 Weekend: 7	Weekday: 0 Weekend: 2	2	0	0
Point Reyes Headland	149	113.62 se 14.84	45	276	179.25 se 36.81	Weekday: 19 Weekend: 3	Weekday: 2 Weekend: 0	2	0	1
2000 Total	3506	-	1342	3108	-	197	194	-	-	-

Table 1g. Summary data for 2001. The maximum numbers were seen during a single census over the entire season. Max # Breed = adults, immatures and pups during the breeding season, March 15 to June 15, recorded by observers with 2 or more years of experience. Avg # Breed= adults, immatures and pups during the breeding season, March 15 to June 15, recorded by observers of all experience levels. Max # Molt =all age classes during the molting season, June 15 to July 15, recorded by observers with two or more years of experience. Avg # Molt = all age classes during the molting season, June 15 to July 15, recorded by all observers. se=Standard error.

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Red Seals	Shark Bites	Dead Pups
Double Point	867	536.20 se 42.12	354	1145	553.12 se 112.83	Weekday: 22 Weekend: 18	Weekday: 12 Weekend: 13	8	3	4
Drakes Estero & Limantour	1023	594.73 se 44.86	336	1292	727.00 se 90.13	Weekday: 22 Weekend: 21	Weekday: 20 Weekend: 22	18	2	1
Tomales Point	487	196.25 se 28.98	194	221	329.14 se 31.06	Weekday: 14 Weekend: 18	Weekday: 6 Weekend: 17	1	0	0
Tomales Bay	611	353.38 se 26.96	179	316	176.57 se 31.81	Weekday: 15 Weekend: 19	Weekday: 3 Weekend: 26	12	0	1
Bolinas Lagoon	295	197.90 se 14.12	123	401	307.57 se 29.58	Weekday: 17 Weekend: 18	Weekday: 14 Weekend: 24	9	2	1
Duxbury Reef	71	32.85 se 4.91	10	99	37.50 se 15.63	Weekday: 15 Weekend: 17	Weekday: 2 Weekend: 4	2	0	0
Point Reyes Headland	131	88.22 se 10.6	51	295	238.00 se 31.67	Weekday: 7 Weekend: 8	Weekday: 0 Weekend: 1	2	0	0
2000 Total	3485	-	1247	3769	-	231	164	-	-	-

Table 2a. Sources of potential and actual disturbances during 1997.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Total
Double Point	1	-	-	1	-	1	2	5	**10**
Drakes Estero & Limantour	6	-	-	-	1	18	3	5	**33**
Tomales Point	-	-	-	-	-	2	-	1	**3**
Tomales Bay	-	-	-	-	-	-	-	-	**0**
Bolinas Lagoon	-	-	-	-	-	-	-	-	**0**
Point Reyes Headland	-	-	-	-	-	-	-	-	**0**
Total	7	0	0	1	1	21	5	11	**46**

Table 2b. Sources of potential and actual disturbances during the 1998 field seasons.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Total
Double Point	-	-	-	-	1	-	3	2	**6**
Drakes Estero & Limantour	-	1	-	-	-	26	1	4	**32**
Tomales Point	3	-	-	-	-	4	-	2	**9**
Tomales Bay	6	4	-	-	1	4	-	3	**18**
Bolinas Lagoon	-	-	3	-	-	1	1	-	**5**
Point Reyes Headland	-	-	-	-	-	-	-	-	**0**
Total	9	5	3	0	2	35	5	11	**70**

Table 2c. Sources of potential and actual disturbances during the 1999 field seasons.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other	Total
Double Point	6	-	-	-	3	5	2	3	2	**21**
Drakes Estero & Limantour	1	5	-	-	5	23	11	11	3	**59**
Tomales Point	1	-	-	-	-	2	1	-	1	**5**
Tomales Bay	7	-	-	1	-	2	2	2	1	**15**
Bolinas Lagoon	-	2	-	3	1	3	6	6	-	**21**
Duxbury Reef	-	-	-	-	-	1	-	-	-	**1**
Point Reyes Headland	2	-	-	-	-	-	-	-	-	**2**
Total	**17**	**7**	**0**	**4**	**9**	**36**	**22**	**22**	**7**	**124**

Table 2d. Sources of potential and actual disturbances during the 2000 field season.

	Motor boat	Non-motor boat	Clammer	Plane	Human	Bird	Unknown	Other	Total
Double Point	4	-	-	7	12	6	18	4	**51**
Drakes Estero & Limantour	-	6	2	9	30	13	19	2	**81**
Tomales Point	8	-	-	4	6	-	4	1	**23**
Tomales Bay	15	2	6	1	-	-	-		**24**
Bolinas Lagoon	-	5	-	-	-	3	3	-	**11**
Duxbury Reef	-	1	-	-	1	-	-	-	**2**
Point Reyes Headland	-	-	-	1	-	-	1	-	**2**
Total	**27**	**14**	**8**	**22**	**49**	**22**	**45**	**7**	**194**

Table 2e. Sources of potential and actual disturbances during the 2001 field season.

	Motor boat	Non-motor boat	Clammer	Plane	Human	Bird	Unknown	Other	Total
Double Point	3	-	-	1	3	1	4	13	**25**
Drakes Estero & Limantour	-	4	-	3	20	4	10	2	**43**
Tomales Point	-	-	-	3	19	-	1	-	**23**
Tomales Bay	17	5	6	-	1	-	-	-	**29**
Bolinas Lagoon	-	12	-	1	6	4	13	2	**38**
Duxbury Reef	-	-	-	-	6	-	-	-	**6**
Point Reyes Headland	-	-	-	1	-	-	-	-	**1**
Total	**20**	**21**	**6**	**9**	**55**	**9**	**28**	**17**	**165**

Table 3a. Summary of seal responses to disturbances during 1997. See methods for definition of seal responses. Percent is the percentage of times the animals flushed into water for each site.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
Double Point	2	-	7	1	70%
Drakes Estero &Limantour	9	-	24	-	73%
Tomales Point	-	-	3	-	100%
Tomales Bay	-	-	-	-	0%
Bolinas Lagoon	-	-	-	-	0%
Point Reyes Headland	-	-	-	-	0%
Total	11	0	34	1	74%

Table 3b. . Summary of seal responses to disturbances during 1998. See methods for definition of seal responses. Percent is the percentage of times the animals flushed into water for each site.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
Double Point	1	2	3	-	50%
Drakes Estero & Limantour	11	6	15	-	47%
Tomales Point	1	1	7	-	78%
Tomales Bay	8	5	5	-	28%
Bolinas Lagoon	3	1	-	1	0%
Point Reyes Headland	-	-	-	-	0%
Total	24	15	30	1	43%

Table 3c. Summary of seal responses to disturbances during 1999. See methods for definition of seal responses. Percent is the percentage of times the animals flushed into water for each site.

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	Head Alert	Flush	Flush Water	Unknown	% Flush Water
Double Point	2	4	11	-	65%
Drakes Estero & Limantour	19	4	31	1	56%
Tomales Point	-	-	3	1	75%
Tomales Bay	2	5	3	1	27%
Bolinas Lagoon	5	-	15	1	71%
Duxbury Reef	-	-	-	1	0%
Point Reyes Headland	-	1	-	1	0%
Total	28	14	63	6	57%

Table 3d. Summary of seal responses to disturbances during 2000. See methods for definition of seal responses. Percent is the percentage of times the animals flushed into water for each site.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
Double Point	3	5	24	10	57%
Drakes Estero & Limantour	15	4	38	13	54%
Tomales Point	3	3	3	10	16%
Tomales Bay	4	1	9	3	53%
Bolinas Lagoon	-	-	11	-	100%
Duxbury Reef	-	-	-	2	0%
Point Reyes Headland	-	1	-	1	0%
Total	25	14	85	39	52%

Table 3e. Summary of seal responses to disturbances during 2001. See methods for definition of seal responses. Percent is the percentage of times the animals flushed into water for each site.

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	Head Alert	Flush	Flush Water	Unknown	% Flush Water
Double Point	1	1	18	2	82%
Drakes Estero & Limantour	7	1	24	3	69%
Tomales Point	1	-	6	13	30%
Tomales Bay	4	2	11	3	55%
Bolinas Lagoon	5	1	31	-	84%
Duxbury Reef	-	-	3	3	50%
Point Reyes Headlands	1	-	-	-	0%
Total	**19**	**5**	**93**	**24**	**66%**

Table 4a. Average number of disturbances per hour during 2000. Hours of direct observation represent the total amount of time that researchers were observing the animals. The number of disturbances represents the total of all potential and actual disturbances. See methods for definition of potential and actual disturbances.

Location	Number of Surveys	Number of Disturbances	# Of Hours of Direct Observation	Average # of Disturbances per Hour	Standard Deviation
Double Point	Weekday: 24 Weekend: 28	Weekday: 12 Weekend: 39	45.5 62.5	0.26 0.62	0.37 0.71
Drakes Estero & Limantour	Weekday: 27 Weekend: 18	Weekday: 43 Weekend: 38	53.5 45.3	0.80 0.83	1.04 0.42
Tomales Point	Weekday: 14 Weekend: 13	Weekday: 12 Weekend: 11	46.5 43.8	0.26 0.25	0.43 0.24
Tomales Bay	Weekday: 12 Weekend: 13	Weekday: 5 Weekend: 19	42.0 43.8	0.12 0.43	0.24 0.56
Bolinas Lagoon	Weekday: 6 Weekend: 9	Weekday: 4 Weekend: 7	17.9 22.5	0.23 0.31	0.25 0.36
Duxbury Reef	Weekday: 4 Weekend: 7	Weekday: 0 Weekend: 2	3.0 6.0	0 0.33	0 0.79
Point Reyes Headland	Weekday: 19 Weekend: 3	Weekday: 2 Weekend: 0	50.3 9.0	0.04 0	0.12 0
All Sites Combined Total	Weekday:106 Weekend: 91 197	Weekday: 78 Weekend:116 194	258.5 232.8 491.3	0.30 0.50 0.39	0.66 0.57 0.63

Table 4b. Average number of disturbances per hour during 2001. Hours of direct observation represent the total amount of time that researchers were observing the animals. The number of disturbances represents the total of all potential and actual disturbances. See methods for definition of potential and actual disturbances.

Location	Number of Surveys	Number of Disturbances	# Of Hours of Direct Observation	Average # of Disturbances per Hour	Standard Deviation
Double Point	Weekday: 22 Weekend: 18	Weekday: 12 Weekend: 13	42.0 39.5	0.29 0.33	0.58 0.40
Drakes Estero & Limantour	Weekday: 22 Weekend: 21	Weekday: 20 Weekend: 22	41.5 45.0	0.48 0.49	0.61 0.71
Tomales Point	Weekday:14 Weekend: 18	Weekday: 6 Weekend: 17	34.0 41.5	0.18 0.41	0.34 0.43
Tomales Bay	Weekday: 15 Weekend: 19	Weekday: 3 Weekend: 26	13.3 20.3	0.23 1.28	0.41 2.52
Bolinas Lagoon	Weekday: 17 Weekend: 18	Weekday: 14 Weekend: 24	42.0 45.5	0.33 0.55	0.34 0.50
Duxbury Reef	Weekday: 15 Weekend: 17	Weekday: 2 Weekend: 4	8.3 9.0	0.24 0.44	0.70 1.12
Point Reyes Headland	Weekday: 7 Weekend: 8	Weekday: 0 Weekend: 1	21.5 27.3	0 0.04	0 0.07
All Sites Combined Total 2001	Weekday: 112 Weekend:119 231	Weekday :57 Weekend: 107 164	202.6 228.1 430.7	0.28 0.47 0.38	0.51 1.20 0.94

Table 5a. Summary data for Double Point, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg. # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	854	NA	357	NA	NA	Weekday: 12 Weekend: 7	Weekday: 4 Weekend: 6	11	1.3%	3	3
1998	708	NA	187	722	NA	Weekday: 18 Weekend: 12	Weekday: 1 Weekday: 5	6	0.8%	6	6
1999	890	NA	335	486	NA	Weekday: 23 Weekend: 13	Weekday: 11 Weekend: 10	11	1.2%	4	5
2000	960	507.70 se 40.24	416	853	657.28 se 57.39	Weekday: 24 Weekend: 28	Weekday: 12 Weekend: 39	5	0.5%	4	5
2001	867	536.20 se 42.12	354	1145	553.12 se 112.83	Weekday: 22 Weekend: 18	Weekday: 12 Weekend: 13	8	0.9%	3	4

Table 5b. Sources of potential and actual disturbances at Double Point during 1997 through 2001. NA= data not available.

	Motor boat	Non-motor boat	Elephant seal	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	1	-	NA	1	-	1	2	5	-	**10**
1998	-	-	NA	-	1	-	3	2	-	**6**
1999	6	-	NA	-	3	5	2	3	2	**21**
2000	4	-	1	-	7	12	6	18	3	**51**
2001	3	-	11	-	1	3	1	4	2	**25**

Table 5c. Summary of seal responses to disturbances at Double Point during 1997 through 2001. See methods for a description of seal responses.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	2	-	7	1	70%
1998	1	2	3	-	50%
1999	2	4	11	-	65%
2000	3	5	24	10	57%
2001	1	1	18	2	82%

Table 5d. Summary of the average numbers of disturbances per hour observed at Double Point during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 24	Weekday: 12	45.5	0.26	0.37
	Weekend: 28	Weekend: 39	62.5	0.62	0.71
2001	Weekday: 22	Weekday: 12	42.0	0.29	0.58
	Weekend: 18	Weekend: 13	39.5	0.33	0.40

Table 6a. Summary data for Drakes Estero and Limantour Estero, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg# Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	1111	NA	257	NA	NA	Weekday: 10 Weekend: 16	Weekday: 3 Weekend: 30	13	1.2%	3	1
1998	753	NA	162	985	NA	Weekday: 11 Weekend: 18	Weekday: 8 Weekend: 24	22	2.9%	2	1
1999	922	NA	285	817	NA	Weekday: 26 Weekend: 19	Weekday: 24 Weekend: 35	27	2.9%	4	2
2000	1020	525.43 se 44.06	376	980	740.83 se 100.58	Weekday: 27 Weekend: 18	Weekday: 43 Weekend: 18	11	1.1%	2	1
2001	1023	594.73 se 44.86	336	1292	727.00 se 90.13	Weekday: 22 Weekend: 21	Weekday: 20 Weekend: 22	18	1.8%	2	1

Table 6b. Sources of potential and actual disturbances at Drakes Estero and Limantour Estero during 1997 through 2001.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	6	-	-	-	1	18	3	5	-	**33**
1998	-	1	-	-	-	26	1	4	-	**32**
1999	1	5	-	-	5	23	11	11	3	**59**
2000	-	6	-	-	9	32	13	19	2	**81**
2001	-	4	1	-	3	20	4	10	2	**44**

Table 6c. Summary of seal responses to disturbances at Drakes Estero and Limantour Estero during 1997 through 2001. Unknown is a disturbance which occurred prior to survey, and the response level is unknown.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	9	-	24	-	73%
1998	11	6	15	-	47%
1999	19	4	31	1	56%
2000	15	4	38	13	54%
2001	7	1	24	3	69%

Table 6d. Summary of the average numbers of disturbances per hour observed at Drakes Estero and Limantour Estero during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 27	Weekday: 43	53.5	0.80	1.04
	Weekend: 18	Weekend: 38	45.3	0.83	0.42
2001	Weekday: 22	Weekday: 20	41.5	0.48	0.61
	Weekend: 21	Weekend: 22	45.0	0.49	0.71

Table 7a. Summary data for Tomales Point, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	420	NA	153	NA	NA	Weekday: 8 Weekend: 1	Weekday: 2 Weekend: 1	3	0.7%	2	1
1998	437	NA	74	504	NA	Weekday: 13 Weekend: 16	Weekday: 3 Weekend: 6	5	1.1%	3	3
1999	430	NA	151	460	NA	Weekday:19 Weekend: 15	Weekday: 5 Weekend: 0	10	2.3%	3	1
2000	451	206.41 se 30.42	189	311	210.33 se 40.61	Weekday: 14 Weekend: 13	Weekday: 12 Weekend: 11	5	1.1%	1	0
2001	487	196.25 se 28.98	194	221	329.14 se 31.06	Weekday: 14 Weekend: 18	Weekday: 6 Weekend: 17	1	0.2%	0	0

Table 7b. Sources of potential and actual disturbances at Tomales Point during 1997 through 2001.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	-	-	-	-	-	2	-	1	-	**3**
1998	3	-	-	-	-	4	-	2	-	**9**
1999	1	-	-	-	-	2	1	-	1	**5**
2000	8	-	-	-	4	6	-	4	1	**23**
2001	-	-	-	-	3	19	-	1	-	**23**

Table 7c. Summary of seal responses to disturbances at Tomales Point during 1997 through 2001. Unknown is a disturbance which occurred prior to a survey, and the response level is unknown.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	-	-	3	-	100%
1998	1	1	7	-	78%
1999	-	-	3	1	75%
2000	3	3	3	10	16%
2001	1	-	6	13	30%

Table 7d. Summary of the average number of disturbances per hour observed at Tomales Point during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 14:	Weekday: 12	46.5	0.26	0.43
	Weekend: 13	Weekend: 11	43.8	0.25	0.24
2001	Weekday: 14	Weekday: 6	34.0	0.18	0.34
	Weekend: 18	Weekend: 17	41.5	0.41	0.43

Table 8a. Summary data for Tomales Bay, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

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	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	530	NA	141	NA	NA	Weekday: 8 Weekend: 1	Weekday: 0 Weekend: 0	14	2.6%	0	1
1998	290	NA	34	310	NA	Weekday: 12 Weekend: 14	Weekday: 7 Weekend: 11	8	2.8%	2	1
1999	625	NA	190	347	NA	Weekday: 19 Weekend: 15	Weekday: 11 Weekend: 4	17	2.7%	1	1
2000	541	354.75 se 31.40	188	290	280.50 se 6.10	Weekday: 12 Weekend: 13	Weekday: 5 Weekend: 19	17	3.1%	0	2
2001	611	353.38 se 26.96	179	316	176.57 se 31.81	Weekday: 15 Weekend: 19	Weekday: 3 Weekend: 26	12	2.0%	0	1

Table 8b. Sources of potential and actual disturbances at Tomales Bay during 1997 through 2001.

	Motor boat	Non-motor boat	Clammer	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	-	-	-	-	-	-	-	-	-	**0**
1998	6	4	-	-	1	4	-	3	-	**18**
1999	7	-	-	-	-	3	2	2	1	**15**
2000	15	2	6	-	1	-	-	-	-	**24**
2001	17	5	6	-	-	1	-	-	-	**29**

Table 8c. Summary of seal responses to disturbances at Tomales Bay during 1997 through 2001. Unknown is a disturbance which occurred prior to a survey and the response level is unknown. See methods on definition of seal responses.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	-	-	-	-	0%
1998	8	5	5	-	28%
1999	2	5	3	1	27%
2000	4	1	9	3	53%
2001	4	2	11	3	55%

Table 8d. Summary of the average numbers of disturbances per hour observed at Tomales Bay during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 12	Weekday: 5	42.0	0.12	0.24
	Weekend: 13	Weekend: 19	43.8	0.43	0.56
2001	Weekday: 15	Weekday: 3	13.3	0.23	0.41
	Weekend: 19	Weekend: 26	20.3	1.28	2.52

Table 9a. Summary data for Bolinas Lagoon, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	212	NA	51	NA	NA	Weekday: 1 Weekend: 2	Weekday: 0 Weekend: 0	5	2.4%	0	1
1998	143	NA	47	267	NA	Weekday: 12 Weekend: 0	Weekday: 5 Weekend: 0	8	5.6%	2	1
1999	192	NA	59	322	NA	Weekday: 18 Weekend: 2	Weekday: 18 Weekend: 4	7	3.6%	0	0
2000	273	163.10 SE 31.41	108	388	352.66 SE 35.48	Weekday: 6 Weekend: 9	Weekday: 4 Weekend: 7	9	3.3%	1	2
2001	295	197.90 SE 14.12	123	401	307.57 SE 29.58	Weekday: 17 Weekend: 18	Weekday: 14 Weekend: 24	9	3.1%	2	1

Table 9b. Sources of potential and actual disturbances at Bolinas Lagoon during 1997 through 2001.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	-	-	-	-	-	-	-	-	**-**	**0**
1998	-	-	3	-	-	1	1	-	**-**	**5**
1999	-	2	-	-	1	4	6	6	3	**22**
2000	-	5	-	-	-	-	3	3	-	**11**
2001	-	12	-	1	1	6	4	13	2	**39**

Table 9c. Summary of seal responses to disturbances at Bolinas Lagoon during 1997 through 2001. Unknown is a disturbance which occurred prior to survey and the response level is unknown. See methods for definition of seal responses.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	-	-	-	-	0%
1998	3	1	-	1	0%
1999	5	-	15	1	71%
2000	-	-	11	-	100%
2001	5	1	31	-	84%

Table 9d. Summary of the average numbers of disturbances per hour observed at Bolinas Lagoon during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 6	Weekday: 4	17.8	0.23	0.25
	Weekend: 9	Weekend: 7	22.5	0.31	0.36
2001	Weekday: 17	Weekday: 14	42.0	0.33	0.34
	Weekend: 18	Weekend: 24	45.5	0.55	0.50

Table 10a. Summary data for Duxbury Reef, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1999	98	NA	10	NA	NA	Weekday: 7 Weekend: 1	Weekday: 0 Weekend: 1	1	1%	0	0
2000	112	31.66 se 12.01	20	10	5 se 5.05	Weekday: 4 Weekend: 7	Weekday: 0 Weekend: 2	2	1.8%	0	0
2001	71	32.85 se 4.91	10	99	37.50 se 15.63	Weekday: 15 Weekend: 17	Weekday: 2 Weekend: 4	2	2.8%	0	0

Table 10b. Sources of potential and actual disturbances at Duxbury Reef during 1999 through 2001.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other
1999	-	-	-	-	-	1	-	-	**1**
2000	-	1	-	-	-	1	-	-	**2**
2001	-	-	-	-	-	6	-	-	**6**

Table 10c. Summary of seal responses to disturbances at Duxbury Reef during 1999 through 2001. Unknown is a disturbance which occurred prior to a survey, and the response level is unknown. See methods for definition of seal responses.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1999	-	-	-	1	0%
2000	-	-	-	2	0%
2001	-	-	3	3	50%

Table 10d. Summary of the average numbers of disturbances per hour observed at Duxbury Reef during 2000 and 2001. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 4	Weekday: 0	3.0	0	0
	Weekend: 7	Weekend: 2	6.0	0.33	0.79
2001	Weekday: 15	Weekday: 2	8.3	0.24	0.70
	Weekend: 17	Weekend: 4	9	0.44	1.12

Table 11a. Summary data for Point Reyes Headland, 1997 through 2001. The reported numbers reflect the maximum number seen during a single census. The percent of red seals is the percentage of the maximum total number of seals. The number of disturbances is the total number for the whole season. Max# breed = adults, immatures and pups during the breeding season, March 15 to June 15. Max # Molt = all age classes during the molting season, June 15 to July 15. NA= data not available and se = standard error.

	Max # Breed	Avg # Breed	Max # Pups	Max # Molt	Avg # Molt	# Surveys	# Disturbances	Reds	% Reds	Shark Bites	Dead Pups
1997	141	NA	24	466	NA	Weekday: 5 Weekend: 2	Weekday: 0 Weekend: 0	0	0	NA	0
1998	150	NA	24	282	NA	Weekday: 13 Weekend: 4	Weekday: 0 Weekend: 0	4	2.7%	1	3
1999	168	NA	38	431	NA	Weekday: 27 Weekend: 4	Weekday: 2 Weekend: 0	2	1.2%	0	0
2000	149	113.62 se 14.84	45	276	179.25 se 36.81	Weekday: 19 Weekend: 3	Weekday: 2 Weekend: 0	2	1.3%	0	1
2001	131	88.22 se 10.64	51	295	238.00 se 31.67	Weekday: 7 Weekend: 8	Weekday: 0 Weekend: 1	2	1.5%	0	0

Table 11b. Sources of potential and actual disturbances at Point Reyes Headland during 1997 through 2001.

	Motor boat	Non-motor boat	Car	Dog	Plane	Human	Bird	Unknown	Other	Total
1997	-	-	-	-	-	-	-	-	-	**0**
1998	-	-	-	-	-	-	-	-	-	**0**
1999	2	-	-	-	-	-	-	-	-	**2**
2000	-	-	-	-	1	-	-	1	-	**2**
2001	-	-	-	-	1	-	-	-	-	**1**

Table 11c. Summary of seal responses to disturbances at Point Reyes Headland during 1997 through 2001. Unknown is a disturbance which occurred prior to a survey and the response level is unknown. See methods for a description of seal responses.

	Head Alert	Flush	Flush Water	Unknown	% Flush Water
1997	-	-	-	-	0%
1998	-	-	-	-	0%
1999	-	1	-	1	0%
2000	-	1	-	1	0%
2001	1	-	-	-	0%

Table 11d. Summary of the average numbers of disturbances per hour observed at Point Reyes Headland during 2000 and 2001 sons. The number of hours of direct observation represents the total amount of time when researchers were observing the animals. The number of disturbances represents the total of all the potential and actual disturbances.

	# Surveys	# Disturbances	#Hours of Direct observation	Average # of Disturbances per Hour	Standard Deviation
2000	Weekday: 19	Weekday: 2	50.3	0.04	0.12
	Weekend: 3	Weekend: 0	9	0	0
2001	Weekday: 7	Weekday: 0	21.5	0	0
	Weekend: 8	Weekend: 1	27.3	0.04	0.07

Table 12a. Harbor seal census summary for the San Francisco Bay Area during the 1998 breeding season. NA = data not available.

Date	Location	Total Count	Pups
4/19/98	Jenner	140	5
	Tomales Bay	135	10
	Tomales Point	239	68
	Point Reyes Headlands	49	3
	Drakes/Limantour	499	67
	Double Point	412	71
	Bolinas Lagoon	106	31
	Fitzgerald Marine Reserve	107	7
	San Mateo Co.	65	10
	Sonoma Co.	0	0
	Sea Ranch	108	29
	South Bean Hollow	NA	NA
	Richmond Bridge	NA	NA
	Yerba Buena	NA	NA
	Mowry Slough	NA	NA
	Grand Total	**1,860**	**301**
5/3/98	Jenner	249	12
	Tomales Bay	290	11
	Tomales Point	192	52
	Point Reyes Headlands	62	20
	Drakes/Limantour	583	126
	Double Point	551	160
	Bolinas Lagoon	88	0
	Fitzgerald Marine Reserve	NA	NA
	San Mateo Co.	155	25
	Sonoma Co.	NA	NA
	Sea Ranch	NA	NA
	South Bean Hollow	68	7
	Richmond Bridge	NA	NA
	Yerba Buena	NA	NA
	Mowry Slough	NA	NA
	Grand Total	**2,238**	**413**
5/6/98	Jenner	NA	NA
	Tomales Bay	290	30
	Tomales Point	437	48
	Point Reyes Headlands	102	18
	Drakes/Limantour	661	192
	Double Point	708	144
	Bolinas Lagoon	113	36
	Fitzgerald Marine Reserve	NA	NA
	San Mateo Co.	NA	NA
	Sonoma Co.	NA	NA
	Sea Ranch	NA	NA
	South Bean Hollow	61	7
	Richmond Bridge	113	8
	Yerba Buena	110	2
	Mowry Slough	NA	NA
	Grand Total	**2,595**	**485**
5/30/98	Jenner	NA	NA
	Tomales Bay	218	14
	Tomales Point	214	17
	Point Reyes Headlands	113	14
	Drakes/Limantour	429	96
	Double Point	585	13
	Bolinas Lagoon	120	25
	Fitzgerald Marine Reserve	217	6
	San Mateo Co.	NA	NA
	Sonoma Co.	183	16
	Sea Ranch	NA	NA
	South Bean Hollow	68	10
	Richmond Bridge	121	4
	Yerba Buena	129	4
	Mowry Slough	10	0
	Grand Total	**2,407**	**219**
6/28/98	Jenner	NA	NA
	Tomales Bay	218	2
	Tomales Point	504	2
	Point Reyes Headlands	282	1
	Drakes/Limantour	932	3
	Double Point	573	12
	Bolinas Lagoon	151	3
	Fitzgerald Marine Reserve	102	2
	San Mateo Co.	134	27
	Sonoma Co.	NA	NA
	Sea Ranch	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	89	1
	Yerba Buena	122	0
	Mowry Slough	128	0
	Grand Total	**3,235**	**53**

Table 12b. (Page 1 of 3**)** Harbor seal census summary for the San Francisco Bay Area during the 1999 breeding and molt seasons**.**

Date	Location	Total Count	Pups
4/18/99	Tomales Bay	187	23
	Tomales Point	103	9
	Point Reyes Headlands	53	6
	Drakes/Limantour	458	74
	Double Point	558	123
	Bolinas Lagoon	104	13
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	114	21
	Yerba Buena	72	3
	Mowry Slough	243	78
	Grand Total	**1892**	**350**
4/25/99	Tomales Bay	308	47
	Tomales Point	35	0
	Point Reyes Headlands	55	12
	Drakes/Limantour	615	208
	Double Point	890	283
	Bolinas Lagoon	147	40
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	108	18
	Yerba Buena	113	4
	Mowry Slough	135	62
	Grand Total	**2406**	**674**
5/10/99	Tomales Bay	625	143
	Tomales Point	232	75
	Point Reyes Headlands	74	29
	Drakes/Limantour	922	237
	Double Point	648	163
	Bolinas Lagoon	146	48
	San Mateo Co.	512	89
	Russian River.	208	24
	South Bean Hollow	NA	
	Richmond Bridge	111	21
	Yerba Buena	NA	NA
	Corte Madera	7	1
	Brooks Island	17	3
	Mowry Slough	132	43
	Grand Total	**3634**	**876**
5/16/99	Tomales Bay	260	55
	Tomales Point	380	71
	Point Reyes Headlands	116	38
	Drakes/Limantour	463	138
	Double Point	738	325
	Bolinas Lagoon	NA	NA
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	108	12
	Yerba Buena	95	7
	Mowry Slough	76	18
	Grand Total	**2236**	**664**

Table 12b. continued next page

Table 12b. (Page 2 of 3) Harbor seal census summary for the San Francisco Bay Area during the 1999 breeding and molt seasons.

Date	Location	Total Count	Pups
5/30/99	Tomales Bay	214	35
	Tomales Point	63	13
	Point Reyes Headlands	88	15
	Drakes/Limantour	293	45
	Double Point	411	81
	Bolinas Lagoon	164	50
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	127	5
	Yerba Buena	110	0
	Mowry Slough	55	7
	Grand Total	**1525**	**251**
6/6/99	Tomales Bay	192	NA
	Tomales Point	147	NA
	Point Reyes Headlands	73	13
	Drakes/Limantour	297	31
	Double Point	428	62
	Duxbury Reef	98	10
	Bolinas Lagoon	142	38
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	139	7
	Yerba Buena	144	1
	Mowry Slough	92	8
	Grand Total	**1752**	**170**

Date	Locations	Total Count	Pups
6/30/99	Tomales Bay	347	0
	Tomales Point	209	0
	Point Reyes Headlands	FOG	FOG
	Drakes/Limantour	624	0
	Double Point	483	0
	Bolinas Lagoon	NA	NA
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	117	2
	Yerba Buena	181	2
	Mowry Slough	203	0
	Grand Total	**2164**	**4**
7/17/99	Tomales Bay	319	-
	Tomales Point	460	-
	Point Reyes Headlands	431	-
	Drakes/Limantour	995	-
	Double Point	300	-
	Duxbury Reef	NA	-
	Bolinas Lagoon	288	-
	San Mateo Co.	NA	-
	Russian River	NA	-
	South Bean Hollow	NA	-
	Richmond Bridge	83	2
	Yerba Buena	NA	NA
	Mowry Slough	135	0
	Grand Total	**3011**	**2**

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Table 12b. (page 3 of 3) Harbor seal census summary for the San Francisco Bay Area during the 1999 breeding and molt seasons.

Date	Location	Total Count	Pups
7/28/99	Tomales Bay	284	0
	Tomales Point	261	0
	Point Reyes Headlands	190	0
	Drakes/Limantour	451	0
	Double Point	32	0
	Bolinas Lagoon	251	0
	San Mateo Co.	NA	NA
	Russian River	NA	NA
	South Bean Hollow	NA	NA
	Richmond Bridge	107	0
	Yerba Buena	137	0
	Mowry Slough	117	0
	Grand Total	**1830**	**0**